GEO S12 Series

Geo S1210 & Geo S1230 Tangent Array Modules

Geo S12 Analog TD Controller

User Manual

GEO S12 Series User Manual V1.02
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GEO Technology is radically new thinking

The GEO R&D Project has, to date, resulted in the following patent applications:

- The GEO Hyperboloid Reflective Wavesource™ differs radically from the megaphone-variant type horns you know and love (or hate). “Tried and true” methods will produce entirely unexpected results. HRW technology produces precise and predictable results.
- The Configurable Directivity Flange. A waveguide that allows the operator to alter its behaviour. An unprecedented NEXO development that is easy to use – once you know how and when.
- The Directivity Phase Device needs no operator input to function, but it is reassuring to know that the coupling of the midrange of the system is considered as important as the high frequencies…
- DSP-driven Directional Sub-bass devices are a new approach to controlling LF/VLF acoustic energy.

GEO is not hard to use when you understand how…

The technology behind GEO is revolutionary, but it is grounded in years of practical experience with the problems of delivering high quality professional sound to large audiences at high SPL levels. The GEO toolbox includes GEOSoft -a simple yet powerful and highly predictive design tool. The array assembly system is keyed to the design software and will easily enable you to deploy your design with great precision. The NX242 Digital TDcontroller provides driver protection and system optimization as well as DSP-driven cardioid pattern control for the CD18, GEO SUB and RS series Directional Subwoofers.

GEO is a high precision system

The GEO HRW™ controls acoustic energy more precisely than other multiple element waveguides. It also makes GEO less forgiving of mistakes. Whilst conventional horns never combine into a coherent array, they may deliver acceptable results even if the design and deployment of the system is less than optimal. This is not the case with GEO where careless installation produces catastrophic results.

A GEO Tangent Array is not a “line array”

GEO Technology is equally effective in designing and deploying tangent horizontal arrays or curved vertical arrays. For best results in a specific application the user needs to know how multi-speaker arrays interact with audience geometry, along with the benefits and drawbacks of curved vertical arrays and horizontal arrays.

Curved tangent arrays require different design techniques

For the past 20 years, sound reinforcement professionals have worked with horizontal arrays that use conventional horns to deliver [more or less] ‘equal power to equal *angles*’. Curved vertical arrays are designed to deliver [more or less] equal power to equal *areas*’. When arrays use conventional horns, the lack of precision, overlap and interference masks errors in array design and aiming. The highly precise GEO wavesource responds accurately, consistently and predictably to the design and deployment of a curved vertical tangent array. This is why the GEO rigging system is designed to control angular splay to 0.01° precision.

GEO curved tangent arrays require different operational techniques

Over the years, system designers and operators have developed a number of signal processing techniques to disguise and partly overcome the limitations of horn design. “Frequency shading,” “amplitude shading,” “system tuning,” all of these are tools of the advanced sound system operator. NONE OF THESE TECHNIQUES ARE APPLICABLE TO GEO TANGENT ARRAYS. Instead of enhancing the array’s performance they will severely degrade it.

Take time to learn how to get great results with GEO Technology. It is an investment that will pay off in more satisfied clients, more efficient operating procedures and more recognition for your skill as a sound system designer and operator. A comprehensive understanding of GEO theory, tangent arrays, and specific features of the GEO S12 Series will help you to operate your system at its full potential.

SAFETY ISSUES

IMPORTANT NOTICE CONCERNING HIGH SOUND PRESSURE LEVELS

Exposure to extremely high noise levels may cause a permanent hearing loss. Individuals vary considerably in susceptibility to noise-induced hearing loss, but nearly everyone will lose some hearing if exposed to sufficiently intense noise for a sufficient time. The U.S. Government's Occupational and Health Administration (OSHA) has specified the following permissible noise level exposures: Sound Duration Per

Day In Hours	Sound Level dBA, Slow Response
8	90
6	92
4	65
3	97
2	100
1 ½	102
1	105
½	110
¼ or less	115

According to OSHA, any exposure in excess of the above permissible limits could result in some hearing loss. Ear plugs or protectors to the ear canals or over the ears must be worn when operating this amplification system in order to prevent a permanent hearing loss, if exposure is in excess of the limits as set forth above. To ensure against potentially dangerous exposure to high sound pressure levels, it is recommended that all persons exposed to equipment capable of producing high sound pressure levels such as this amplification system be protected by hearing protectors while this unit is in operation.

SYSTEM RIGGING SAFETY RULES

Before use of GEO S12, please ensure that anyone involved in system deployment understands the rigging and stacking Safety rules are described in chapter "GEO S12 hardware setup procedure", "SAFETY FIRST" pages 31 to 33 . Failure to do this exposes people to potential injury or death.

ELECTRICAL SAFETY

WARNING ! GEO S12 TDCONTROLLER AND NX242 DIGITAL CONTROLLER ARE CLASS 1 APPARATUS AND MUST BE EATHED.

The green and yellow wire of the mains cord must always be connected to an installation safety earth or ground. The earth is essential for personal safety as well as the correct operation of the system, and is internally connected to all exposed metal surfaces.

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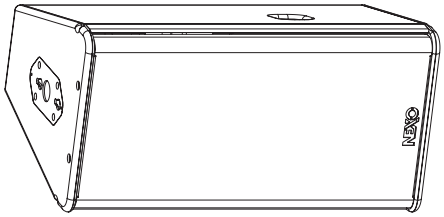
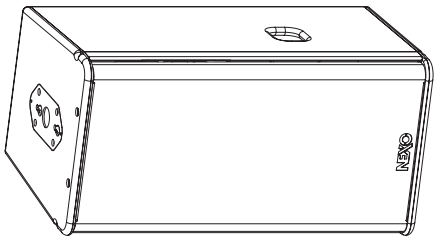
1 INTRODUCTION

Thank you for selecting a NEXO GEO S12 Series Tangent Array System. This manual is intended to provide you with necessary and useful information about your GEO S12 System, which includes the following products:

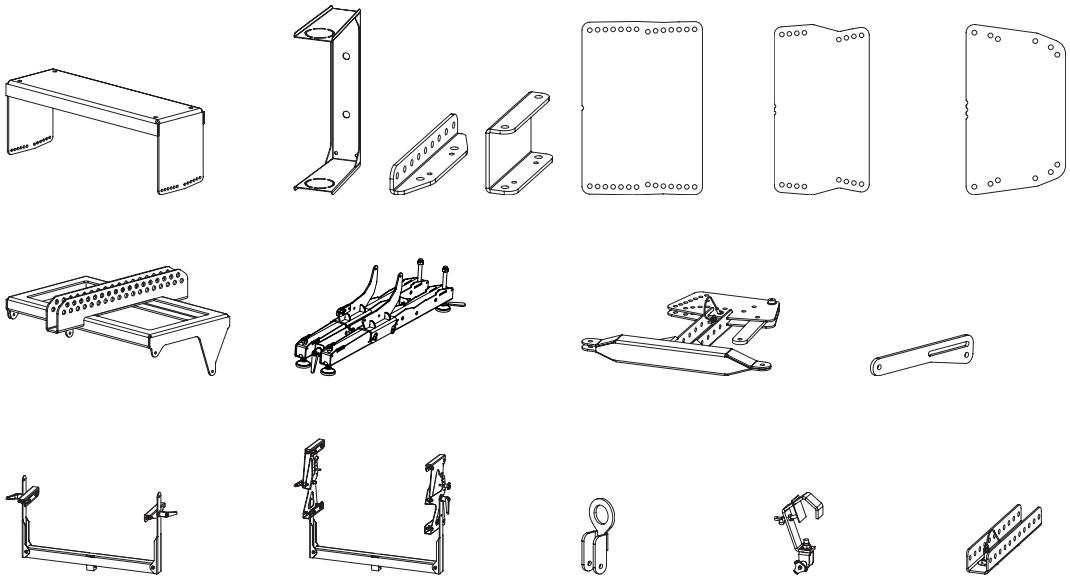


- GEO S1230 is a 30° Tangent Array Module. It comprises 1x12" (30cm) Neodynium 16 ohms LF/MF driver and 1x3" voice coil, 1.4" Throat 16 Ohm HF Driver loaded by a 28.5° Hyperboloid Reflective Wavesource™.



- GEO S1210 is a 10° Tangent Array Module. It comprises 1x12" (30cm) Neodynium 16 ohms LF/MF driver and 1x3" voice coil, 1.4" Throat 16 Ohm HF Driver loaded by a 5° Hyperboloid Reflective Wavesource™.

- GEO S12 Accessory Range. a full range of accessories that provides safe, flexible and simple means of installing Geo S12 Tangent Arrays in fixed installation as well as in touring applications.



As for all NEXO systems, GEO S12s are controlled, powered and monitored by dedicated NEXO TDControllers:

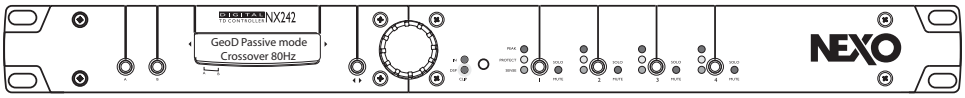
- GEO S12 TDController is based on PS analogue TDController design, and provides full control for RS15 subwoofer in omnidirectional mode associated to Geo S12. It has 2 analogue inputs (Left and Right) and 3 analogue outputs (RS15 Mono Omni, GeoS12 Left and GeoS12 Right);
- NX242-ES4 Digital TDController provides comprehensive control of GEO S12 loudspeakers in multiple configurations. It allows Ethersound™ digital audio networking, as well as remote control for all units in the network. It has 2 analogue / 4 digital inputs and 4 analogue / 4 digital outputs;

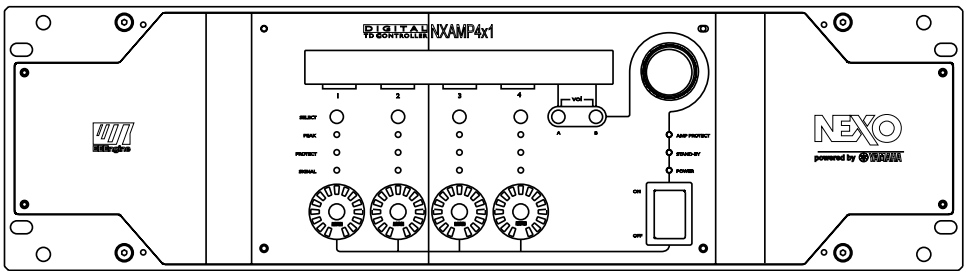
IMPORTANT

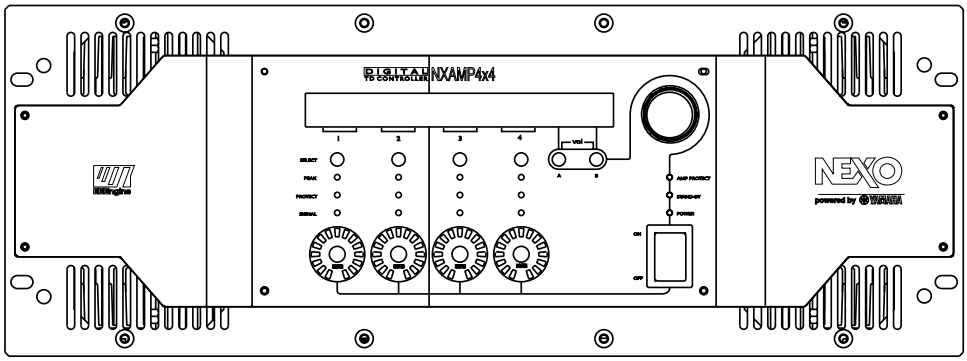
NX242 must be equipped with NX-Tension Card (ES4 or CAI) to access GEO S12 setups

- NXAMP4x1 and NXAMP 4x4 are Powered Digital Controllers, providing full control and amplification for RS15 in multiple configurations. Both devices feature 4 analogue inputs and 4 speaker outputs. When equipped with optional card, 4 digital inputs in Ethersound™ digital audio network format as well as remote control for all units in the network become available.

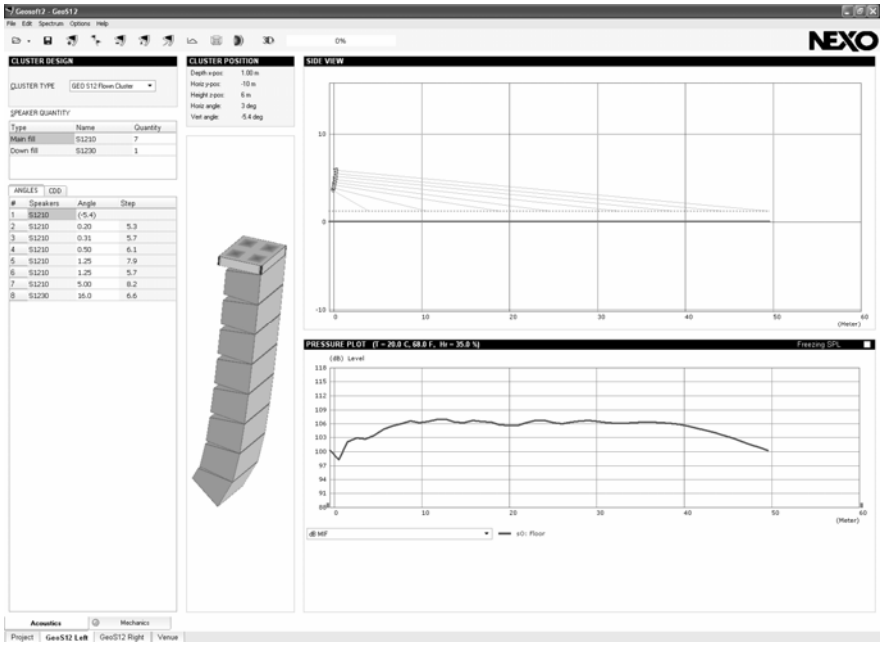
For a complete description of these controllers, please refer to User Manuals. The NX242 and NXAMP DSP algorithms and parameters are fixed in software and updated regularly: Please consult the NEXO web site (www.nexo.fr) for the latest software releases.







- GEOSoft2 Array Design Software assists in the design and implementation of vertical tangent GEO arrays. Please consult the NEXO web site (www.NEXO.fr or www.NEXO-sa.com) for the latest software releases.



Please devote your time and attention to reading this manual. A comprehensive understanding of GEO theory, tangent arrays and specific features of GEO S12 will help you to operate your system at its full potential.

2 GEO S12 GENERAL SET-UP INSTRUCTIONS

2.1 Speaker connection

2.1.1 GEO S12 connectors

GEO S12 is connected with Speakon NL4FC plugs (not supplied). A wiring diagram is printed on the connection panel located on the back of each cabinet.The 4 pins of the 2 Speakon sockets identified in / out are connected in parallel within the enclosure.

Either connector can be used to connect amplifier or to link to an additional Geo S12 cabinet or to link to an optional Sub (if present). Therefore, a single 4-conductor cable can connect two amplifier channels to various Geo S12 and/or Sub Bass.

Connectors are wired as follows:

Speakon Connector		Passive Mode	Active Mode
1(-)	⇨	Not Connected	Geo S12 LF (-)
1(+)	⇨	Not Connected	Geo S12 LF (+)
2(-)	⇨	Geo S12 (-)	Geo S12 HF (-)
2(+)		Geo S12 (+)	Geo S12 HF (+)

2.1.2 Configuring Geo S12 for Passive or Active Mode

- Remove the six TORX screws that hold the connector panel (figure next page);
- Remove the connector panel so that filter WAGO connectors become accessible;
- In Passive Mode, connector A (from filter) should be inserted in connector B (PCB “Passive In”), and Connector D (“Passive Out”) should be connected to speakers via connector C.
- In Active Mode, WAGO Connector A (from filter) should be directly connected into to speakers via connector C (PCB connectors B & D are then unused).

2.1.3 Cabling

NEXO recommends the exclusive use of multi-conductor cables to connect the system: the cable kit is compatible with all the cabinets, and there is no possible confusion between LF, MF and HF sections.

Cable choice consists mainly of selecting cables of the correct sectional dimension (size) in relation to the load resistance and the cable length. Too small a cable section will increase both its serial resistance and its capacitance; this reduces the electrical power delivered to the loudspeaker and can also induce response (damping factor) variations.

For a serial resistance less or equal to 4% of the load impedance (damping factor = 25), the maximum cable length is given by:

$$L_{max} = Z \times S \qquad S \text{ in } mm^2, Z \text{ in Ohm}, L_{max} \text{ in meters}$$

The table below indicates these values, for 3 common sizes.

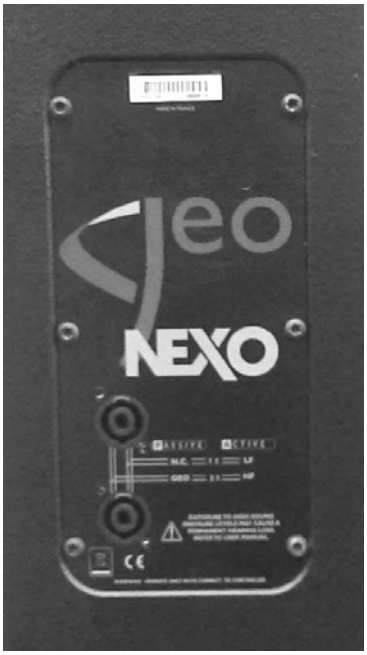
Load Impedance (Ω)	2	3	4	6	8	12	16
Cable section	**Maximum Length (meters)**						
1,5 mm² (AWG #14)	3	4.5	6	9	12	18	24
2,5 mm² (AWG #12)	5	7.5	10	15	20	30	40
4 mm² (AWG #10)	8	12	16	24	32	48	64

2.1.4 Example:

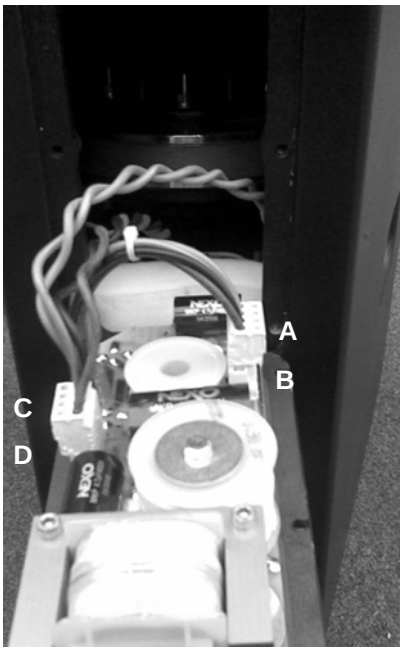
- GEO S12 has a 16 Ohms nominal impedance in passive mode, so 4x Geo S12 wired in parallel will present a 16/4 = 4 Ohm load impedance. The maximum acceptable 2x2.5 mm^2 (AWG #12) cable length L_{max} for such a cluster is 10 meters.

IMPORTANT

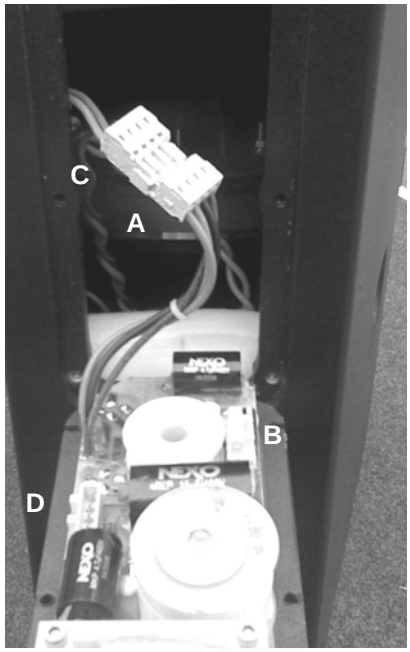
Long speaker cables induce capacitive effects – up to hundreds of pF depending on the quality of the cable - with a high-pass effect on high frequencies. If long speaker cables must be used, ensure that they do not remain coiled while in use.



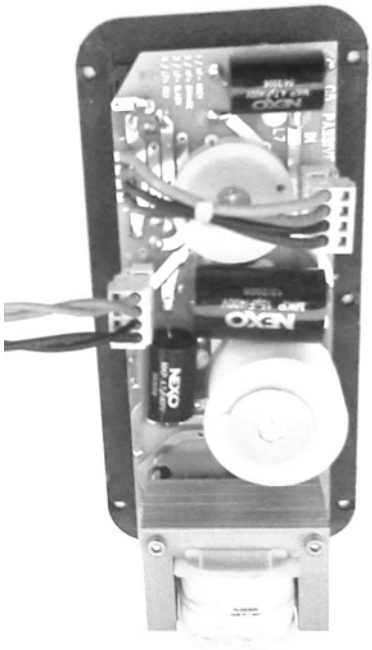
CONNECTOR PANEL

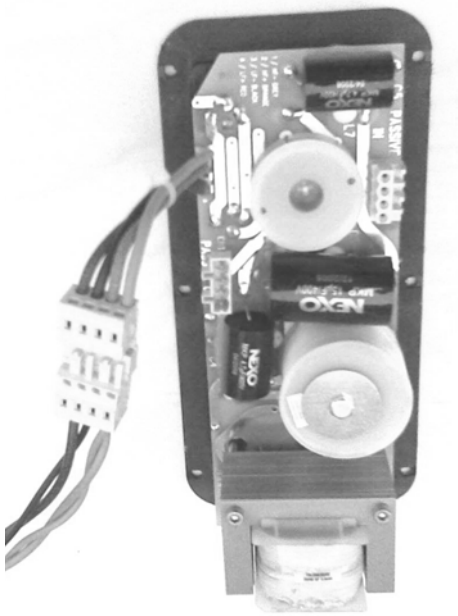


PASSIVE MODE



ACTIVE MODE





3 AMPLIFIER SELECTION FOR USE WITH GEO S12S

NEXO recommends high power amplifiers in all cases. Budget constraints are the only reason to select lower power amplifiers. A lower power amplifier will not reduce the chances of driver damage due to over-excursion, and may actually increase the risk of thermal damage due to sustained clipping. If an incident occurs on an installation without protection, the fact that amplifiers only generating half their rated output power (-3dB) are used will not change anything in respect of possible damage. This is due to the fact that the RMS power handling of the weakest component in the system is always 6 to 10 dB lower than the amplifier rating.

3.1 GEO S12 recommended amplification

GEO S12 is rated for very high power handling and has a 16 Ohms nominal impedance in passive mode or 2 x 16 Ohms nominal impedance in active mode.

These high impedance values allow connection of 3 to 6 cabinets in parallel for each amplifier channel.

Nexo recommends amplifiers in agreement with table below:

Recommended Amplifier#	Channel 1 LF in Active Mode or LF+HF in Passive Mode	Channel 2 HF in Active Mode
GEO S12 Passive Mode 3 in parallel (5.3 Ohms load)	1750 to 3100 W / 4 Ohms	
GEO S12 Active Mode 3 in parallel (5.3 Ohms load)	1750 to 3100 W / 4 Ohms	875to 1550 W / 4 Ohms
GEO S12 Passive Mode 4 in parallel (4 Ohms load)	2000 W to 3600 W / 4 Ohms	-
GEO S12 Active Mode 4 in parallel (4 Ohms load)	2000 to 3600 W / 4 Ohms	1000 to 1800 W / 4 Ohms
GEO S12 Passive Mode 6 in parallel (2.7 Ohms load)	3300 to 6000 W / 2 Ohms	
GEO S12 Active Mode 6 in parallel (2.7 Ohms load)	3300 to 6000 W / 2 Ohms	1650 to 3000 W / 2 Ohms

3.1.1 Current rating

It is very important that the amplifier behaves correctly under low load conditions. A speaker system is reactive by nature: on transient signals like music it will require four to ten times more instantaneous current than its nominal impedance would indicate. Amplifiers are generally specified by continuous RMS power into resistive loads, however the only useful information about current capacity is the specification into a 2 Ohm load. It is possible to perform an amplifier listening test by loading the amps with twice the number of cabinets considered for the application (2 speakers per channel instead of one, 4 instead of 2) and running the amps up to the onset of clipping. If the signal does not noticeably deteriorate, the amplifier is well adapted (overheating after approximately ten minutes is normal but thermal protection must not operate too quickly after starting this test).

3.1.2 Amplifier settings

Gain value

Gain is the key to correct alignment of the system. It is especially important to know the gain of all amplifiers used in your set-up. The tolerance should be about ±0.5 dB. In practice this can be difficult to achieve because:

- Some amplifier brands have an identical input sensitivity for models of different power rating (this infers a different voltage gain for each model). For example, a range of amplifiers with different power outputs, all having a published input sensitivity of 775mV/0dBm or 1.55V/+6dBm, will have a wide range of actual gains – the higher the power, the greater the gain.
- Various other brands may offer constant gain but only within a given product range, for example they may fit fixed input sensitivity only on their semi-professional amps.
- Even if a manufacturer applies the constant gain rule to all models, the value selected will not necessarily be the same as that chosen by other manufacturers.
- Some products can exhibit manufacturing tolerances for the same model of ±1dB or more. Some amplifiers may have been modified, possibly without any label indicating the new values. Others may have gain switches fitted internally where it is impossible for the user to verify the actual setting without opening the amplifier casing.
- In cases where you don't know the gain of your amplifier (or want to check it) please follow this procedure:
    1) Unplug any loudspeakers from the amplifier outputs
    2) With a signal generator, feed a sine wave at 1000Hz at a known voltage (say 0.5V) to the input of the amplifier under test
    3) Measure the voltage at the output of the amplifier
    4) Calculate the gain using the formula Gain = 20 * LOG_{10}(Vout/Vin).

Some examples:

Vin / Gain	20dB	26dB	32dB	37dB (1.4V sensitivity / 1350Wrms)
0.1 V	1 V	2 V	4 V	7.1 V
0.5 V	5 V	10 V	20 V	35.4 V
1 V	10 V	20 V	40 V	70.8 V

Remember that constant sensitivity settings will give a different gain value when the amplifier power is different.

NEXO recommends low gain amplifiers: +26dB is recommended, as it is at the same time adequately low and quite common amongst amplifier manufacturers. This gain setting improves signal to noise ratio and allows all preceding electronic equipment, including the NX242 TDcontroller or GEO S12 TDController, to operate at optimum level. Remember that using a high gain amplifier will raise the noise floor proportionally.

Operating Mode

Most two channel amplifiers available on the pro-audio market have the following operating modes:

- Stereo: two fully independent channels deliver identical power into identical loads
- NEXO recommends Stereo Mode for all amplifier channels feeding GEO S12's.
- Bridge-Mono: the second signal channel processes the same input as the first channel, but with reversed phase. The (single) load is connected between the two positive channel outputs using a suitable connection. While the total output of the amplifier remains the same, the available output voltage, the minimum impedance that can be connected and the voltage gain are doubled as compared with stereo operation. Typically, only channel 1 input is active. Positive and negative output connections vary depending on amplifier manufacturers.
- NEXO does not recommend Bridge Mono Mode unless amplifier power is clearly not sufficient.

IMPORTANT

When in Bridge-Mono mode, check your amplifier user manual for proper connection of outputs 1(+) and (2+) in relation to input phase.

- Parallel-mono: the output terminals of the two channels are configured in parallel using an internal relay. The (single) load is connected either to the output of channel 1 or to that of channel 2 (as if in stereo). While the total output of the amplifier remains the same the output voltage level is also the same as in stereo mode. The minimum impedance that can be connected is reduced by half due to the fact that current capability is doubled. Typically, only channel 1 input is active.
- NEXO does not recommend Parallel-Mono Mode for any GEO S12 amplification.

Warning on amplifiers signal processing features

Some high-end amplifiers may include signal processing functions similar to those found in the NX242 TDcontroller or in GEO S12 TDController ("loudspeaker offset integration", "limiter", "compressor," etc.). Moreover, when this processing is digital, computation latency time can introduce a few milliseconds delay from input to output. These functions are not adapted to specific system requirements and may interfere with the complex protection algorithms used in the NX242.

NEXO do not advise using other protection systems in conjunction with the NX242 and they should be disabled.

IMPORTANT

For proper system protection, no latency time or non-linear devices should be introduced between the output of the NX242 TDcontroller and the input of loudspeakers through use of DSP modules such as internal amplifier signal processing.

3.1.3 Example

For a 6 GEO S12 cluster, and considering an amplifier model which is capable of delivering 2 x 3300W into 2 Ohms or 2 x 2300W into 4 Ohms, NEXO recommends the following quantities and settings:

- Geo S12 Passive Mode:
- 1 stereo amplifier, 3 x GEO S12 per amplifier channel, mode switch in Stereo position, Gain switch in 26 dB gain position, all dynamic or filter processing switches off.

3.2 GEO S12s and NXAMP TDControllers

NEXO Powered TDControllers NXAMP 4X1 & 4X4 are integrated solutions for Control and amplification for all NEXO speaker ranges.

NXAMP4x1 and NXAMP4x4 power capability is listed in the table below:

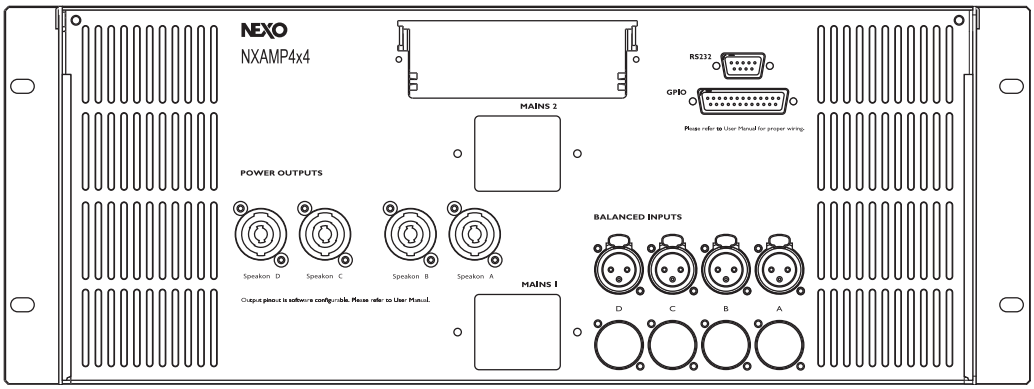
Mode	4 Channels	Bridge Stereo
NXAMP4x1	4 x 650 Watts / 8 Ohms 4 x 900 Watts / 4 Ohms 4 x 1300 Watts / 2 Ohms	2 x 1800 Watts / 8 Ohms 2 x 2600 Watts / 4 Ohms
NXAMP4x4	4 x 1900 Watts / 8 Ohms 4 x 3400 Watts / 4 Ohms 4 x 4000 Watts / 2 Ohms	2 x 6800 Watts / 8 Ohms 2 x 8000 Watts / 4 Ohms

3.2.1 NXAMP connectors

NXAMP4x1 and NXAMP4x4 rear panels feature:

- 4 analog inputs / outputs (links) on XLR3 connectors;
- 4 digital inputs / outputs on RJ45 connectors with optional card;
- 4 speaker level outputs on NL4FC connectors.

Figure below shows connectors implementation on the rear panel.



3.2.2 GEO S12s and NXAMP recommended configurations

	Passive Mode	Active Mode
3 GEO S12	1 channel of NXAMP4x1 in Bridge Stereo Mode 1 channel of NXAMP4x4 in 4 channels mode	2 channels of NXAMP4x1 in Bridge Stereo Mode 2 channels of NXAMP4x4 in 4 channels mode
4 GEO S12	1 channel of NXAMP4x4 in 4 channels mode	2 channels of NXAMP4x4 in 4 channels mode

4 GEO S12 SETUPS ON NEXO TD CONTROLLERS

4.1 Digital NX242-ES4 and NXAMP TDControllers

At GEO S12 User Manual current version printing time, 38 setups combining GEO S12s with NEXO subwoofers are available in NX242 / NXAMP load 2.45. Please consult www.nexo-sa.com for upgrade releases.

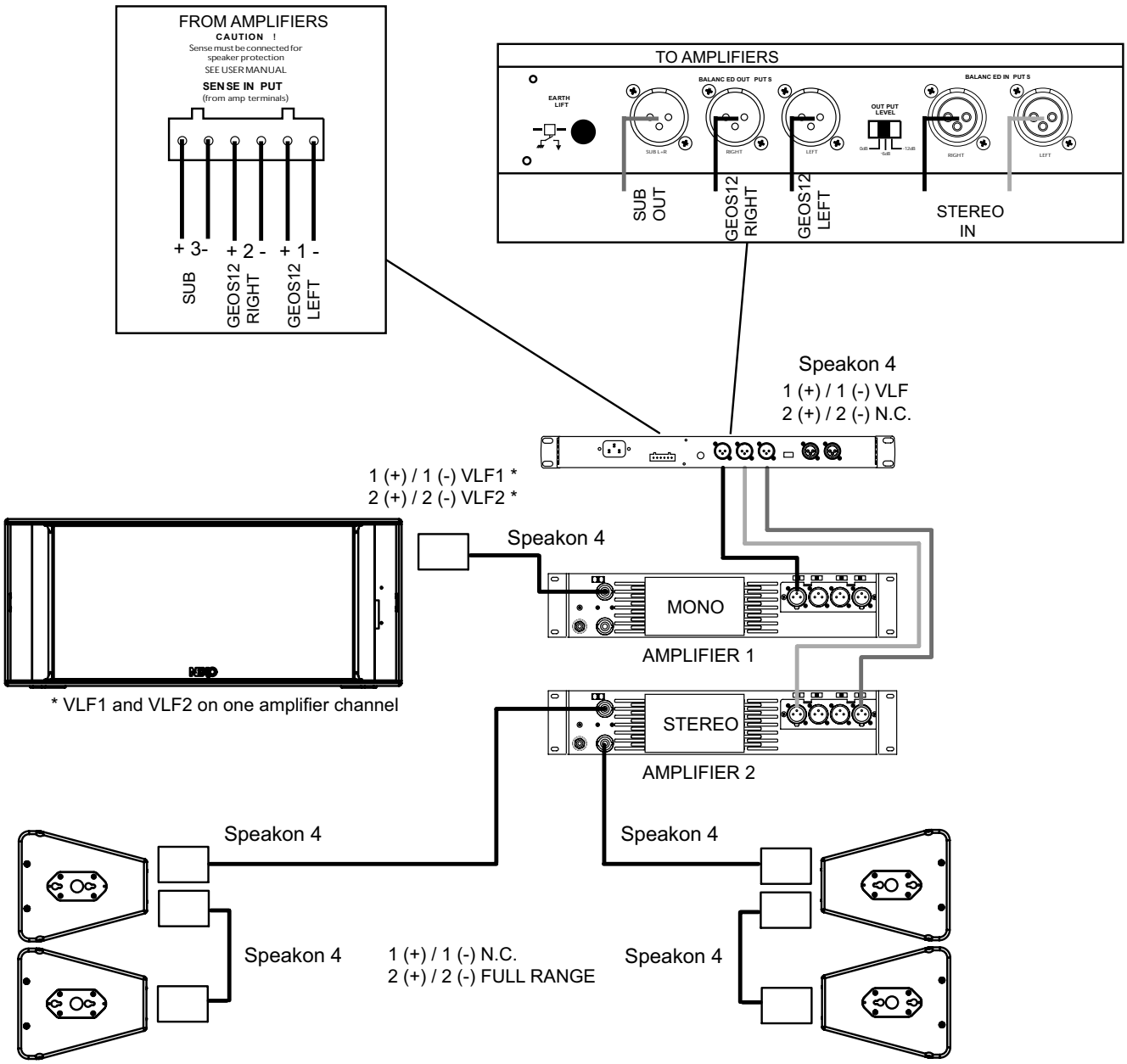
GEO S12	- 4 x S1210 Passive Wideband; - 4 x S1230 Passive Wideband; - 2 x S1210 Active Wideband; - 2 x S1230 Active Wideband; - 2 x S1210 Active X-Over 80 Hz; - 2 x S1230 Active X-Over 80 Hz;
GEO S12 & ALPHA S2	- 2 x S1210 Passive Wideband + 2 x Alpha S2; - 2 x S1230 Passive Wideband + 2 x Alpha S2; - 2 x S1210 Passive X-Over 80 Hz + 2 x Alpha S2; - 2 x S1230 Passive X-Over 80 Hz + 2 x Alpha S2;
GEO S12 & GEO SUB	- 2 x S1210 Passive Wideband + 1 x GeoSub 35 Hz – 80 Hz; - 2 x S1230 Passive Wideband + 1 x GeoSub 35 Hz – 80 Hz; - 2 x S1210 Passive Wideband + 1 x GeoSub 35 Hz – 200 Hz; - 2 x S1230 Passive Wideband + 1 x GeoSub 35 Hz – 200 Hz; - 2 x S1210 Passive X-Over 80 Hz + 1 x GeoSub 35 Hz – 80 Hz; - 2 x S1230 Passive X-Over 80 Hz + 1 x GeoSub 35 Hz – 80 Hz; - 2 x S1210 Passive X-Over 80 Hz + 1 x GeoSub 35 Hz – 200 Hz; - 2 x S1230 Passive X-Over 80 Hz + 1 x GeoSub 35 Hz – 200 Hz; - 2 x S1210 Active X-Over 80 Hz + 1 x GeoSub 35 Hz – 80 Hz; - 2 x S1230 Active X-Over 80 Hz + 1 x GeoSub 35 Hz – 80 Hz; - 2 x S1210 Active X-Over 80 Hz + 1 x GeoSub 35 Hz – 200 Hz; - 2 x S1230 Active X-Over 80 Hz + 1 x GeoSub 35 Hz – 200 Hz;
GEO S12 & CD18	- 2 x S1210 Passive Wideband + 1 x CD18 85Hz; - 2 x S1230 Passive Wideband + 1 x CD18 85 Hz; - 2 x S1210 Passive X-Over + 1 x CD18 85 Hz; - 2 x S1230 Passive X-Over + 1 x CD18 85 Hz; - 2 x S1210 Active X-Over + 1 x CD18 85 Hz; - 2 x S1230 Active X-Over + 1 x CD18 85 Hz;
GEO S12 & RS15	- 2 RS15 omni 35Hz-80Hz + 2 x S1210 Passive Wideband - 2 RS15 omni 35Hz-80Hz + 2 x S1230 Passive Wideband - 1 x RS15 cardio 35Hz-80Hz + 1 x S1210 Active Wideband - 1 x RS15 cardio 35Hz-80Hz + 1 x S1230 Active Wideband - 2 RS15 omni 35Hz-80Hz + 2 x S1210 Passive X-Over - 2 RS15 omni 35Hz-80Hz + 2 x S1230 Passive X-Over - 1 x RS15 cardio 35Hz-80Hz + 2 x S1210 Passive X-Over - 1 x RS15 cardio 35Hz-80Hz + 2 x S1230 Passive X-Over - 1 x RS15 cardio 35Hz-80Hz + 1 x S1210 Active X-Over - 1 x RS15 cardio 35Hz-80Hz + 1 x S1230 Active X-Over

4.2 Analogue GEOS12 TDController

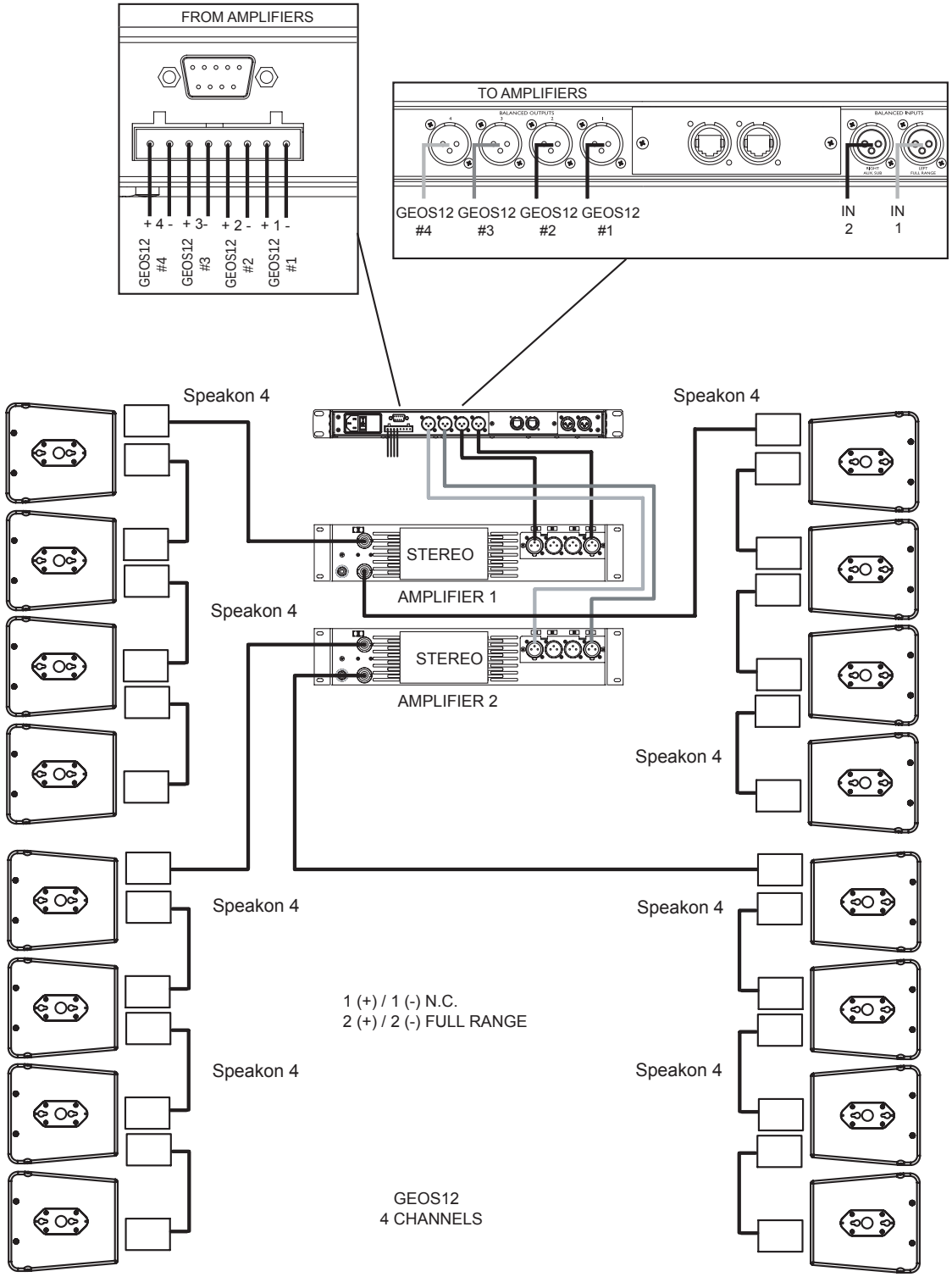
GEO S12 TDController parameters have been optimized for 1 x RS15 (omni mode, mono) used in conjunction with 2 x GEO S1210's or 2 Geo x S1230's (mono or stereo).

5 CONNECTION DIAGRAMS

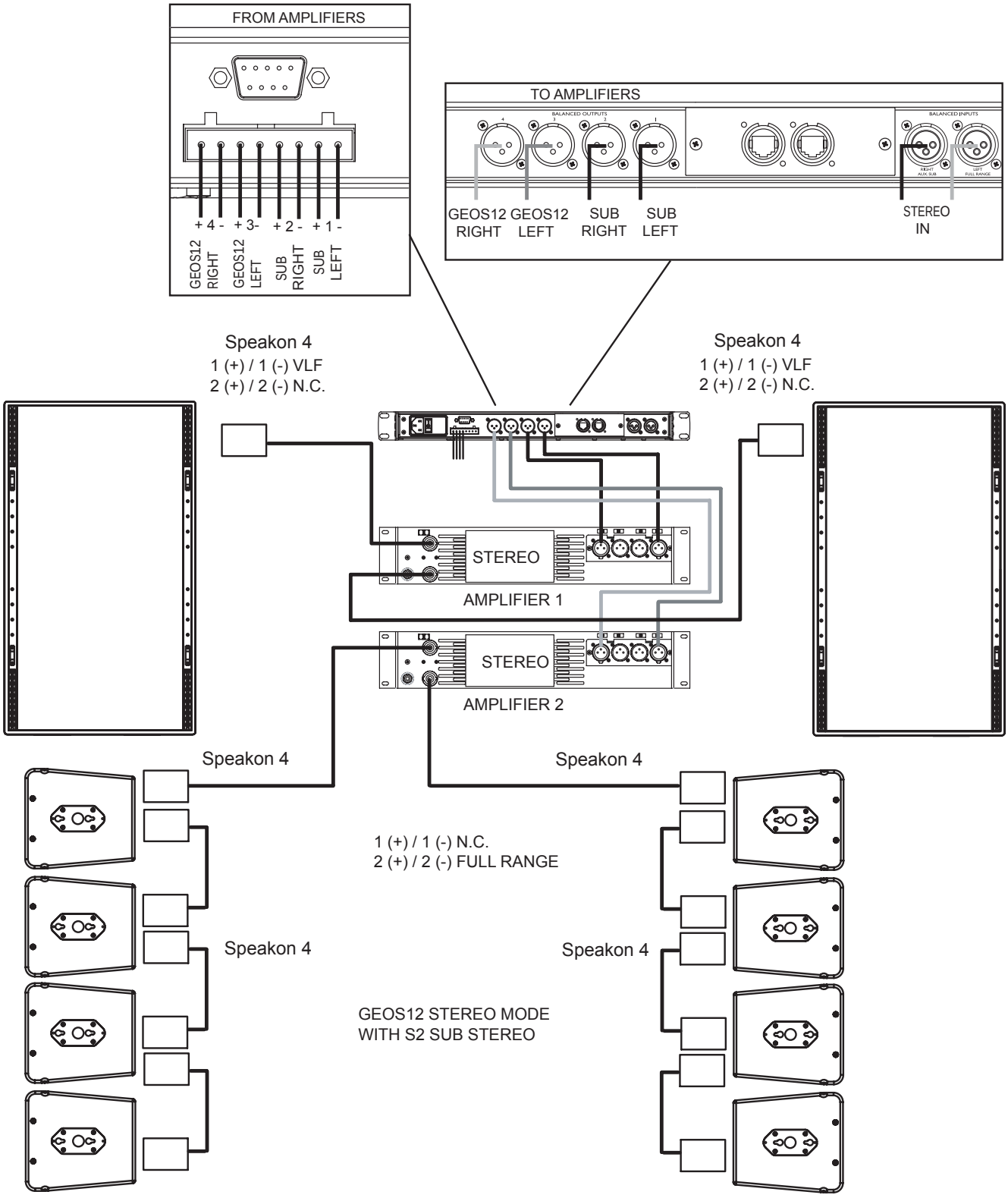
5.1 GEO S12 & RS15 with GEOS12 TDController (Mono Omni Mode)



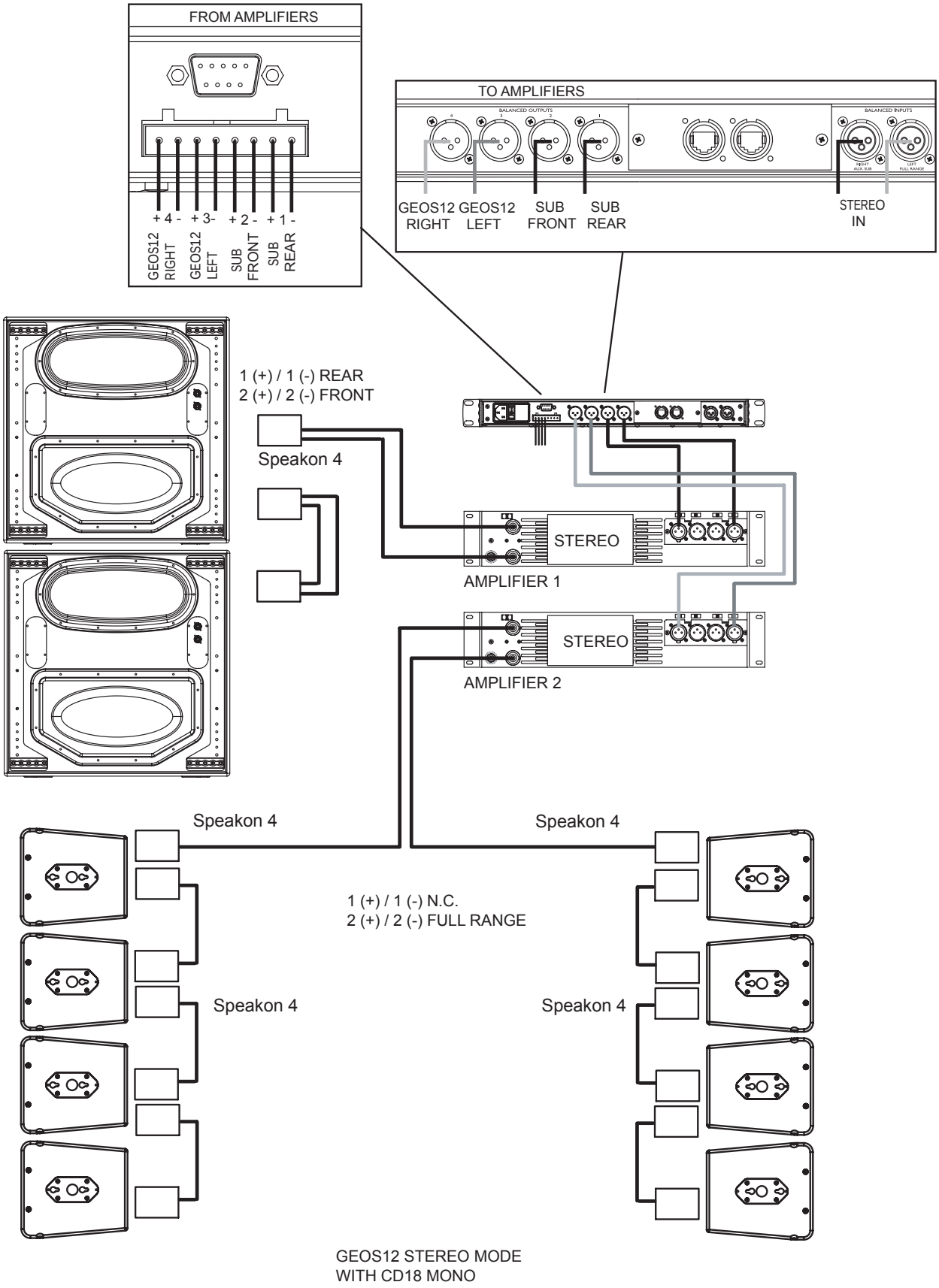
5.2 GEO S12 / NX242-ES4 (4 channels passive mode)



5.3 GEO S12 / ALPHA S2 / NX242-ES4 (Stereo passive mode)

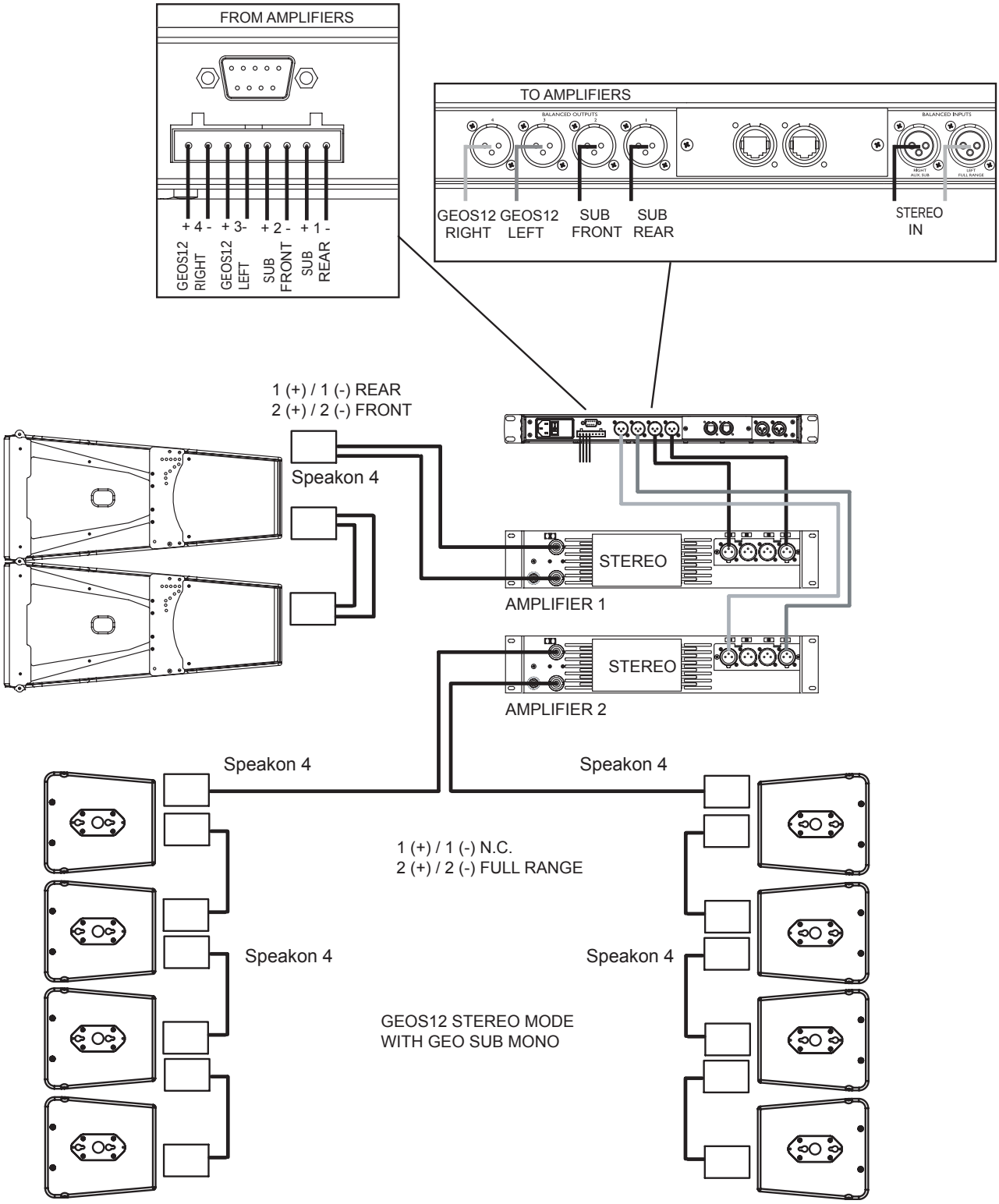


5.4 GEO S12 / CD18 / NX242-ES4 (Stereo passive mode)

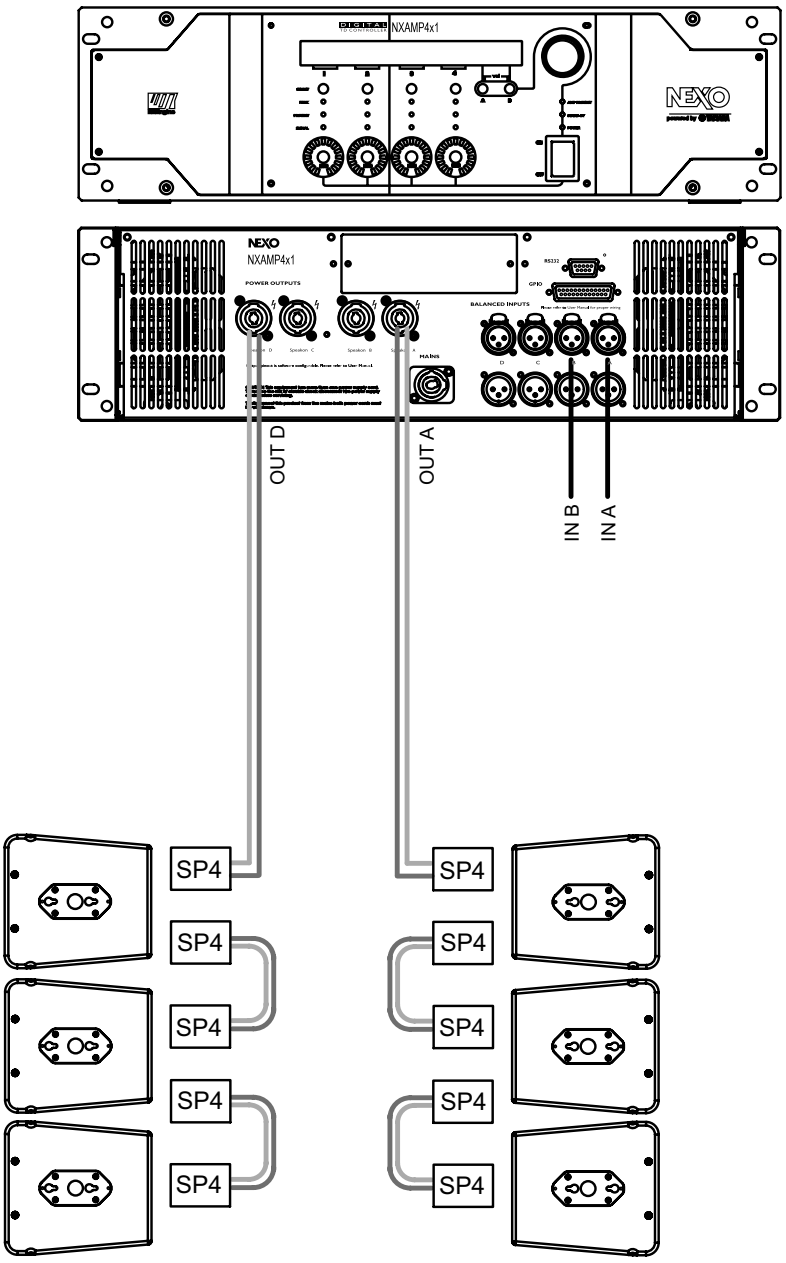


GEOS12 STEREO MODE
WITH CD18 MONO

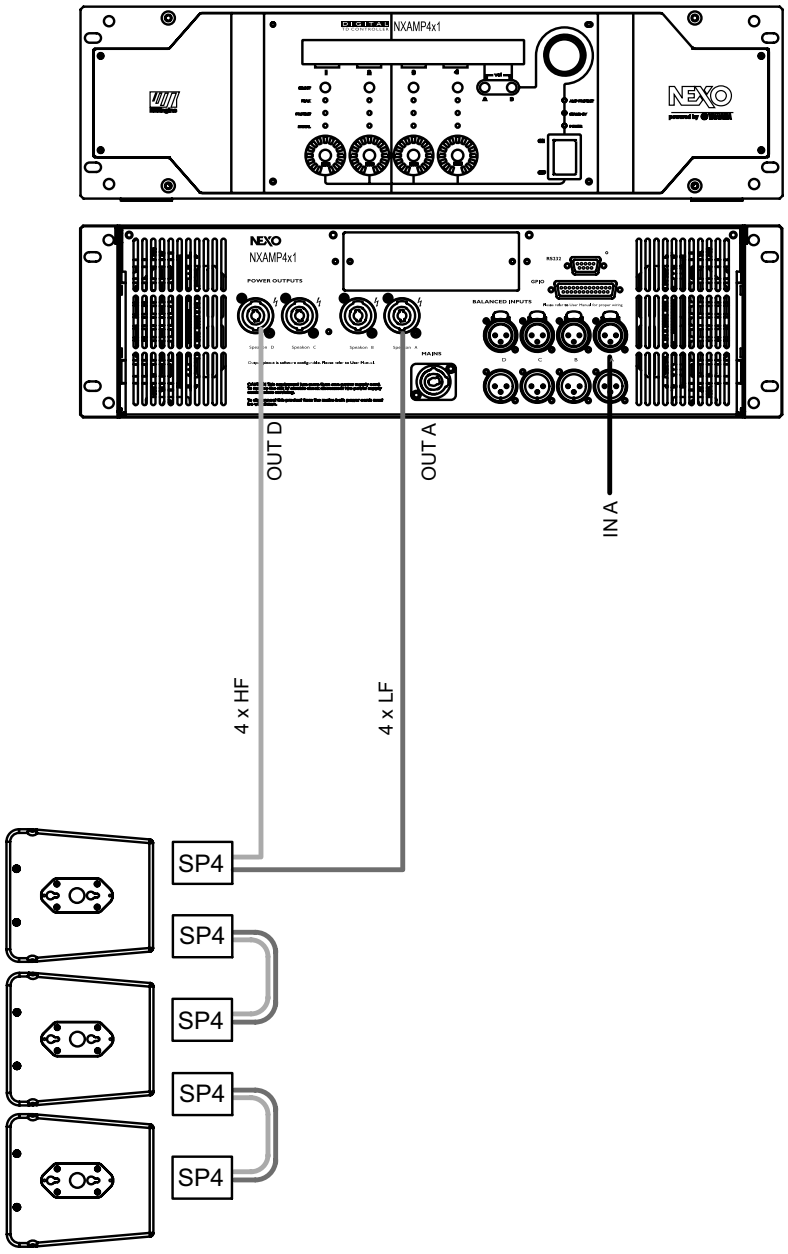
5.5 GEO S12 / GEO SUB / NX242-ES4 (Stereo passive mode)



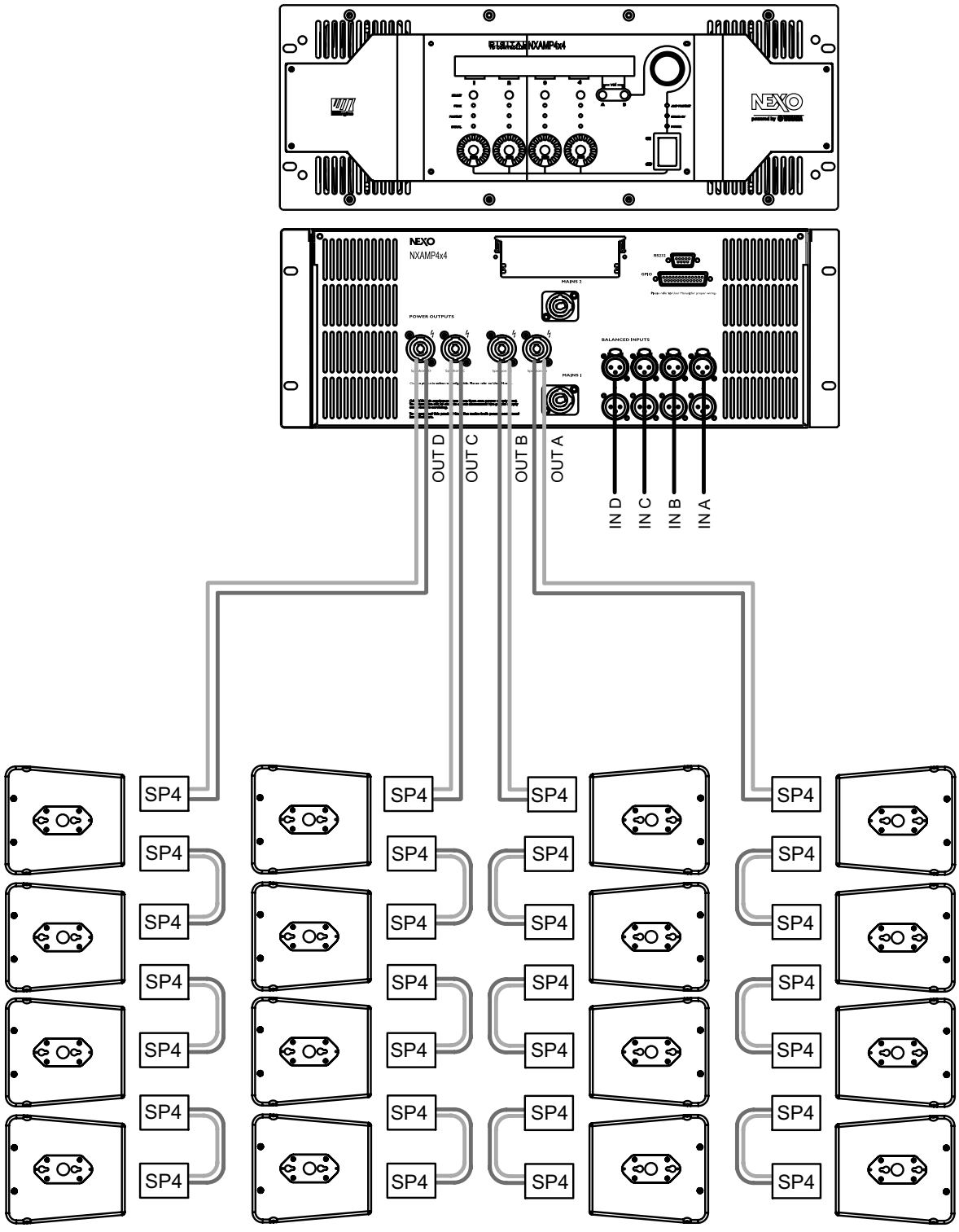
5.6 GEO S12 / NXAMP4x1 (Bridge Stereo - Passive mode)



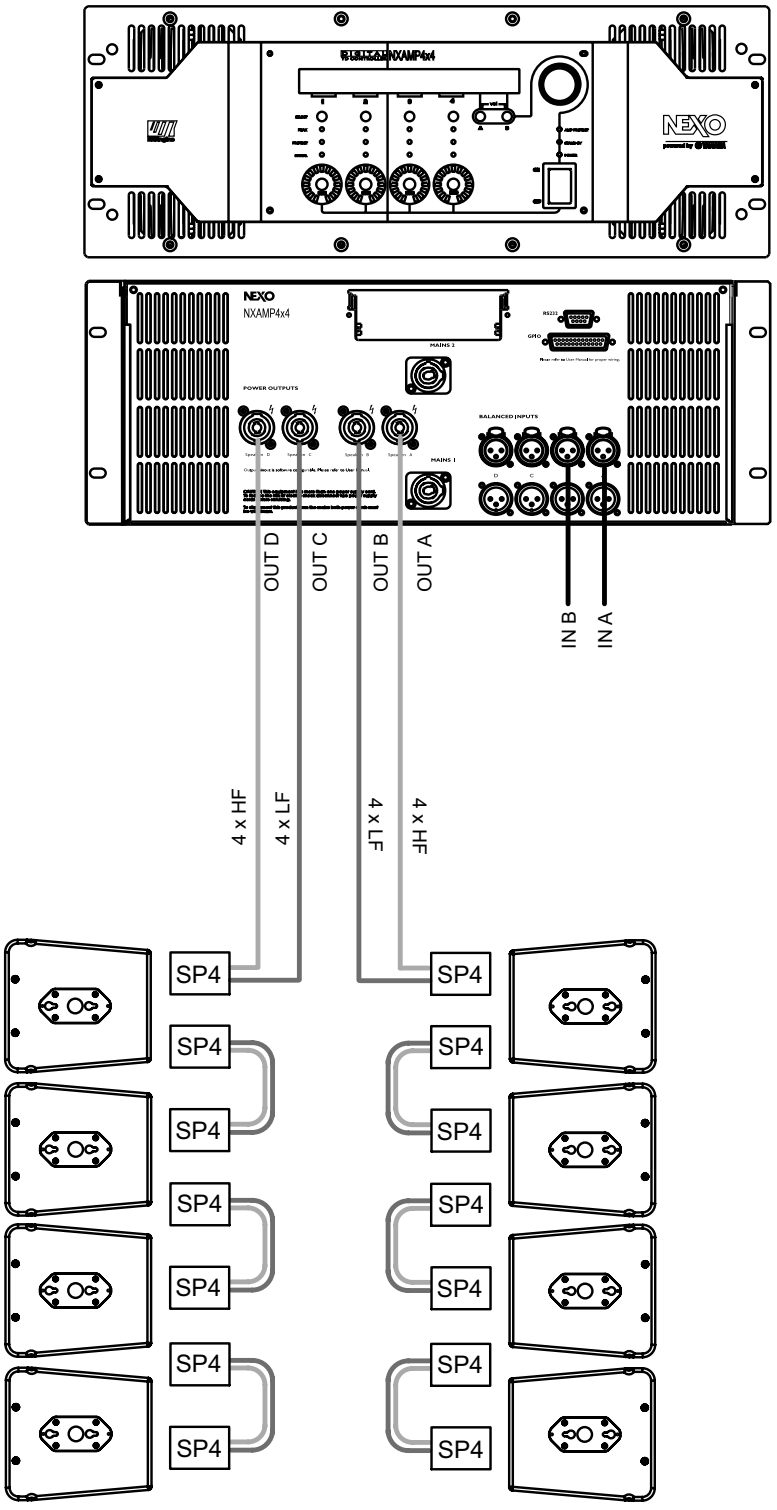
5.7 GEO S12 / NXAMP4x1 (Bridge Stereo - Active mode)



5.8 GEO S12 / NXAMP4x4 (4 Channels - Passive mode)



5.9 GEO S12 / NXAMP4x4 (Stereo Active mode)



6 GEOSOFT2

GEOSoft2 software is a R&D simulation tool derived application. It processes measured speaker data with complex mathematical algorithms to assist the user in designing vertical GEO Tangent Arrays that provide even SPL throughout the depth of the audience. Due to the complexity of the interaction of multiple cabinets, it is simply not possible to reliably design curved vertical arrays without using the processing power of a computer to predict the optimum array structure for a given audience geometry. The design logic is far more complex than looking at a section drawing of the venue, measuring the overall angle needed to cover the audience from the cluster location, and dividing by 10 degrees to determine the required amount number of GEO S1210 cabinets.

GEOSoft2 is an easy to use tool that allows to shape the energy leaving the cluster to fit the audience. It predicts pressure levels radiated from the system to ensure enough cabinets are provided for the application, as well as mechanical constraints for safe flown systems.

In addition, it provides mechanical information for all clusters in agreement with Structural Analysis Reports (available in the Help section): dimensions, weight, gravity center position, forces, moments, working load and safety factor.

GEOS8, GEOT and GEOD Structural Analysis Reports have been validated by German Certification Organization RWTUV systems GmbH.

Geo S12 Structural Analysis Report is currently being examined by German Certification Organization RWTUV systems GmbH.

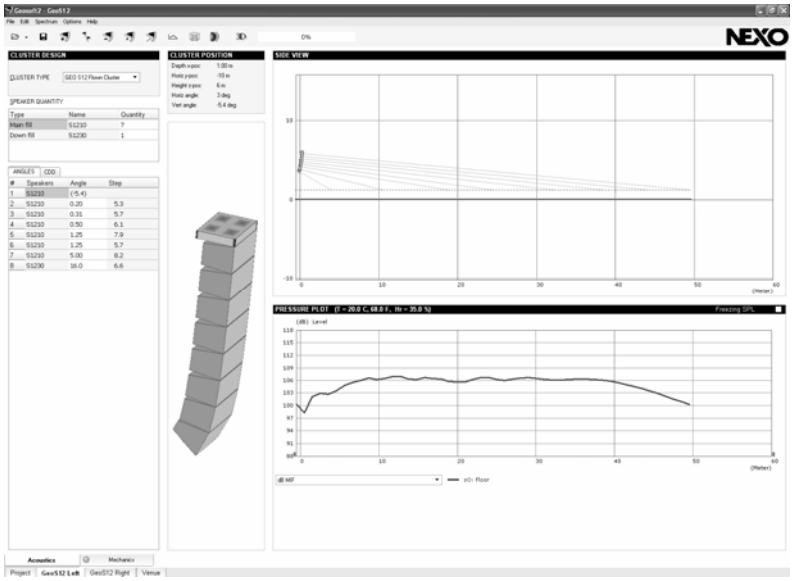
Geosoft2 installation package includes all GEO User Manuals, Structural Analysis Reports and Certificates PDF files (which can be found in the last section of User Manuals).

Geosoft2 is a freeware downloadable on www.nexo-sa.com. Please check our website periodically for upgrades.

IMPORTANT

Never install a GEO S12 cluster without checking its acoustical performances and mechanical safety in Geosoft2 prior to installation.

Any question or bug report please contact geosoft@nexo.fr



GEOSOFT2 ACOUSTIC PAGE

7 CONFIGURABLE DIRECTIVITY DEVICE

The GEO Wavesource controls dispersion of acoustic energy using an hyperboloid acoustical reflector in the “coupling plane” (the vertical plane of a curved vertical tangent array) and a diffraction slot in the “non-coupling plane” (the horizontal plane of a curved vertical tangent array). The patented Configurable Directivity Device consists of bolt-on flanges that alter the diffraction slot’s exit flare rate.

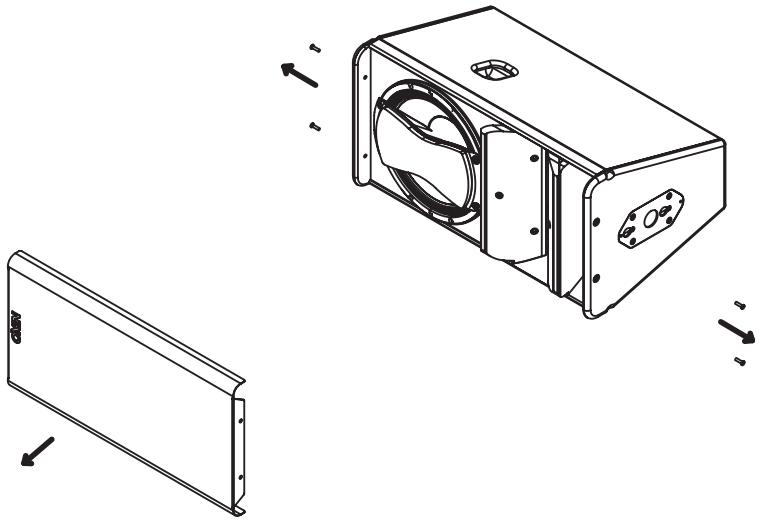
7.1 Installing & removing GEO’s Configurable Directivity flanges

GEO S12 are shipped in the 80° dispersion configuration;

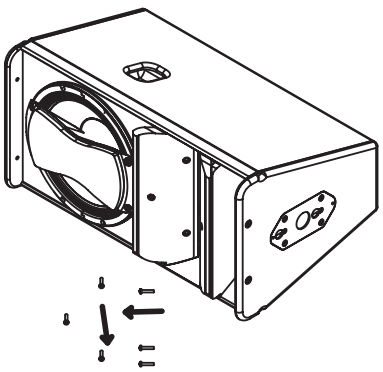
120° flanges is an optional accessory.

To change dispersion in the non-coupling plane to 120°:

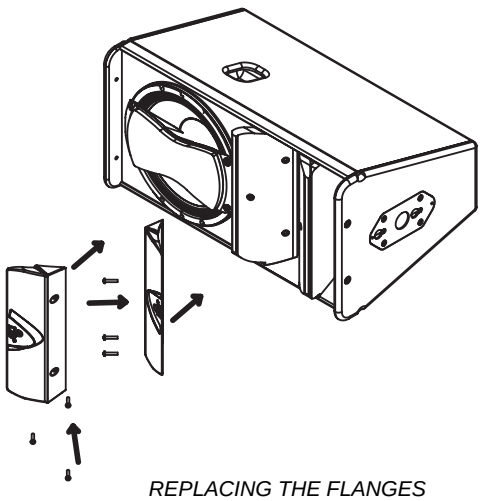
- Remove the front grill (drawings below);
- Remove the three TORX (5x25) screws per flange on each side of the GEO Waveguide (drawings below);
- Install the 120° flanges with the six TORX screws
- Re-install the grid, being careful that the NEXO logo must be on the 12” loudspeaker side.



REMOVING THE GRILL



REMOVING THE SCREWS

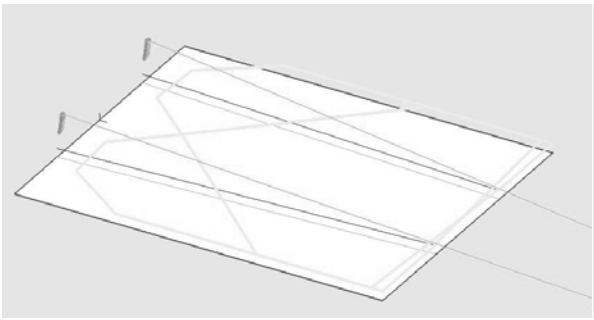


REPLACING THE FLANGES

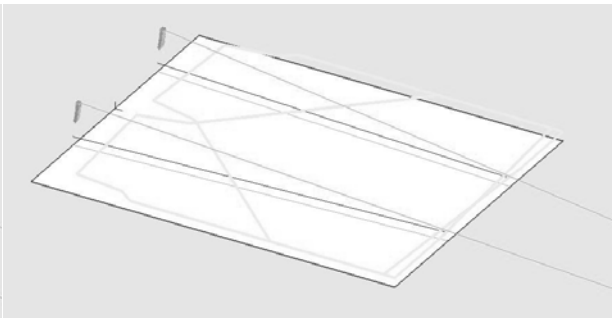
7.2 When & where to use Configurable Directivity flanges

The diagrams show audience area coverage for a stereo system. While the GEO cluster will deliver even SPL from the front to the rear of this audience area, there are “holes” near the front in the centre and at the outside edges. We cannot fill the outside coverage gaps without enlarging the centre gap, and vice versa (left figure below).

If 120° Configurable Directivity Devices are installed at the bottom cabinet of the clusters, coverage will look more like the pattern in right figure below.



-6dB coverage, all GEO S12 in 80° configuration

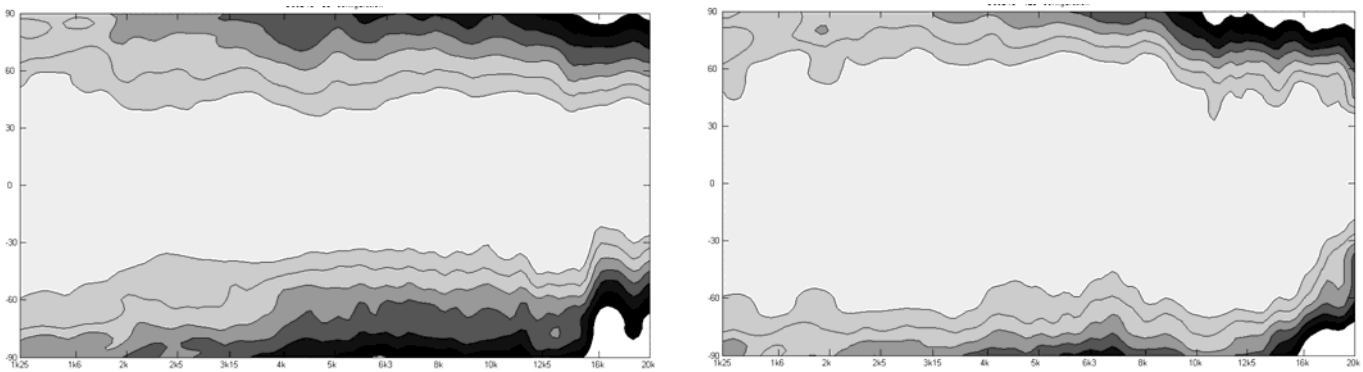


-6dB coverage, bottom GEO S12 in 120° configuration

In curved vertical arrays, the 120° Configurable Directivity Device can be used:

- On the bottom row of curved vertical arrays, to fill in coverage gaps in the front rows.
- On all rows of curved vertical arrays, in cases where 120° of horizontal coverage is preferred to 80°.

Figure below shows isocontour coverage for 80° and 120° configurations.



80° AND 120° CONFIGURATIONS ISOCONTOUR COVERAGE

8 GEO S12 HARDWARE SETUP PROCEDURE

Before proceeding with assembly of GEO S12 arrays, please ensure that the components are present and undamaged. A component list is appended to this manual. In the event of any shortage, please contact your supplier.

For maximum efficiency the GEO S12 rigging system requires three experienced persons for set-up: typically one motor hoist operator, and one GEO S12 operator per side of the array. Good synchronisation and crosscheck between the operators are key elements for a reliable and safe set-up.

8.1 SAFETY FIRST

GEO S12 Rigging System structural computations and related documents are available in Geosoft2 or at Nexo (info@nexo.fr) upon request.

We include this section to remind you of safe practice when flying the GEO S12 system. Please read it carefully. However, user must always apply his or her knowledge, experience and common sense. If in any doubt, seek advice from your supplier or NEXO agent.

This manual offers guidance only for GEO S12 loudspeaker systems. References in this manual to other rigging equipment such as motor hoists, steels, shackles etc. are made to clarify the description of GEO S12 procedures. The user must ensure that operators are properly trained by other agencies in the use of these items.

The GEO S12 Rigging System has been optimised for the deployment of curved vertical or horizontal tangent arrays of GEO S12 loudspeakers. Angle adjustment between cabinets has been limited to specific settings to ensure correct acoustic coupling.

The GEO S12 Rigging System is a professional precision tool set, and should be handled with extreme care. Only persons who are fully conversant with the operation of the GEO S12 Rigging System and provided with suitable safety equipment should deploy GEO Arrays. Misuse of the GEO S12 Rigging System could lead to dangerous consequences.

Used and maintained correctly, the GEO S12 Rigging System will give many years of reliable service in portable systems. Please take the time to read and understand this manual. Always use GEOSoft2 to determine the optimum angle settings for a particular venue, hang point and curved vertical GEO S12 cluster. Applied forces and moments are strongly cabinet quantity and angle configuration dependent. Cluster configuration must be implemented and validated in Geosoft2 prior to installation.

8.1.1 Flown Systems Safety

- Always inspect all the rigging components and cabinets for damage before assembly. Pay special attention to the lifting points, and safety clips. If you suspect that any of the components are damaged or defective, DO NOT USE THE AFFECTED PARTS. Contact your supplier for replacements.
- Read this manual carefully. Also be familiar with the manuals and safe working procedures for any ancillary equipment that will be used with the GEO S12 Rigging System.
- Applied forces and moments are strongly cabinet quantity and angle configuration dependent. Cluster configuration must be implemented and validated in Geosoft2 prior to installation.
- Ensure that all local and National regulations regarding the safety and operation of flying equipment are understood and adhered to. Information on these regulations can usually be obtained from Local Government Offices.
- When deploying a GEO S12 system always wear protective headwear, footwear and eye protection.
- Do not allow inexperienced persons to handle a GEO S12 system. Installation personnel should be trained in loudspeaker flying techniques and should be fully conversant with this manual.
- Ensure that motor hoists, hoist control systems and ancillary rigging components are currently certified as safe and that they pass a visual inspection prior to use.

- Ensure that public and personnel are not allowed to pass beneath the system during the installation process. The work area should be isolated from public access.
- Never leave the system unattended during the installation process.
- Do not place any object, no matter how small or light, on top of the system during the installation procedure. The object may fall when the system is flown and is likely to cause injury.
- Secondary safety steels must be installed once the system has been flown to the operating height. Secondary steels must be fitted irrespective of requirements of the local safety standards applicable to the territory.
- Ensure that the system is secure and prevented from pivoting around the motor hoist.
- Avoid any form of excessive dynamic loading to the assembly (structural computations on GEO S12 Rigging System are based on a 1/1.2 factor for hoist or motor acceleration).
- NEVER attach any item to the GEO S12 system other than the GEO S12 accessories.
- When flying outdoor systems ensure that the system is not exposed to excessive wind or snow loads and is protected from rainfall.
- The GEO S12 Rigging System requires regular inspection and testing by a competent test centre. NEXO recommend that the system is load tested and certified annually or more frequently if local regulations require.
- When de-rigging the system ensure that the same duty of care is given to the procedure as for the installation. Pack GEO S12 components carefully to prevent damage in transit.

8.1.2 Ground Stacking Safety

Statistically, many more injuries occur due to unstable ground stacked PA systems than those associated with flown systems. There are several reasons for this fact, however the message is clear:

- Always survey the supporting structure upon which a ground stack is to be built. Always look beneath PA wings to inspect the deck support and if necessary ask for the stage scrims and dressings be removed to allow access.
- If the stage surface slopes, as it does in some theatres, ensure that the system is prevented from sliding forwards due to vibration. This may require the fitting of timber battens to the stage floor.
- For outdoor systems ensure that that the system is protected from wind forces which might cause the ground stack to become unstable. Wind forces can be huge, especially upon large systems, and should never be underestimated. Observe meteorological forecasts, calculate the “worst case” effect upon the system prior to erection and ensure that the system is secured appropriately.
- Take care when stacking cabinets. Always employ safe lifting procedures and never attempt to build stacks without sufficient personnel and equipment.
- Never allow anyone, whether operators, artists or members of the public to climb onto a ground stacked PA system. Anyone who needs to climb over 2m (6 ft) high should be fitted with suitable safely equipment including a clip-on harness. Please refer to local Health and Safety legislation in your territory. Your dealer can help with advice on access to this information.
- Apply the same attention to all safety matters when de-stacking systems.
- Be aware that safety procedures are as important in the truck and in the warehouse as they are at the venue.

8.1.3 Contacts

Correct training is fundamental to safe practise when working with loudspeakers flying systems. NEXO recommend that users contact local industry associations for information on specialist course.

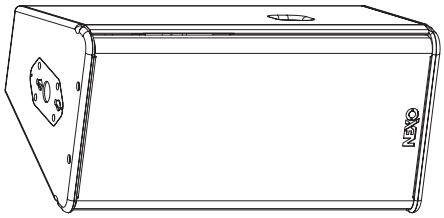
Information for International training agencies can be obtained by contacting either:

The Production Services Association (PSA),
School Passage,
Kingston-upon-Thames,
KT1 SDU Surrey,
ENGLAND
Telephone: +44 (0) 181 392 0180

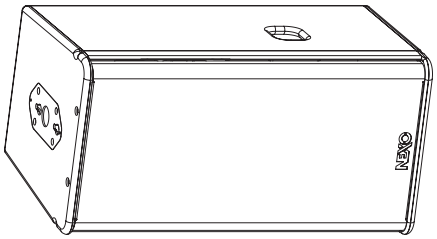
Rigstar Training and Testing Center
82 Industrial Dr. Unit 4
Northampton, Massachusetts 01060 U.S.A.
Phone: 413-585-9869 -- Fax: 413-585-9872
school@rigstar.com

ESTA
Entertainment Services & Technology Association
875 Sixth Avenue, Suite 1005
NEW YORK, NY 10001 USA
Phone: 212-244-1505 – Fax: 212-244-1502
info@esta.org - www.esta.org

8.2 General Description

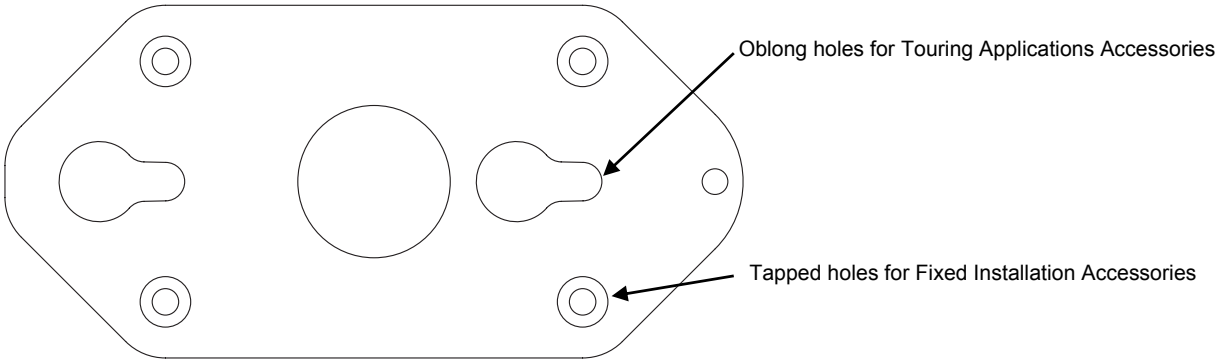


GEO S1230



GEO S1210

GEO S1230 and GEO S1210 incorporate two connecting plates (one per side) on which a comprehensive range of accessories can be mounted.

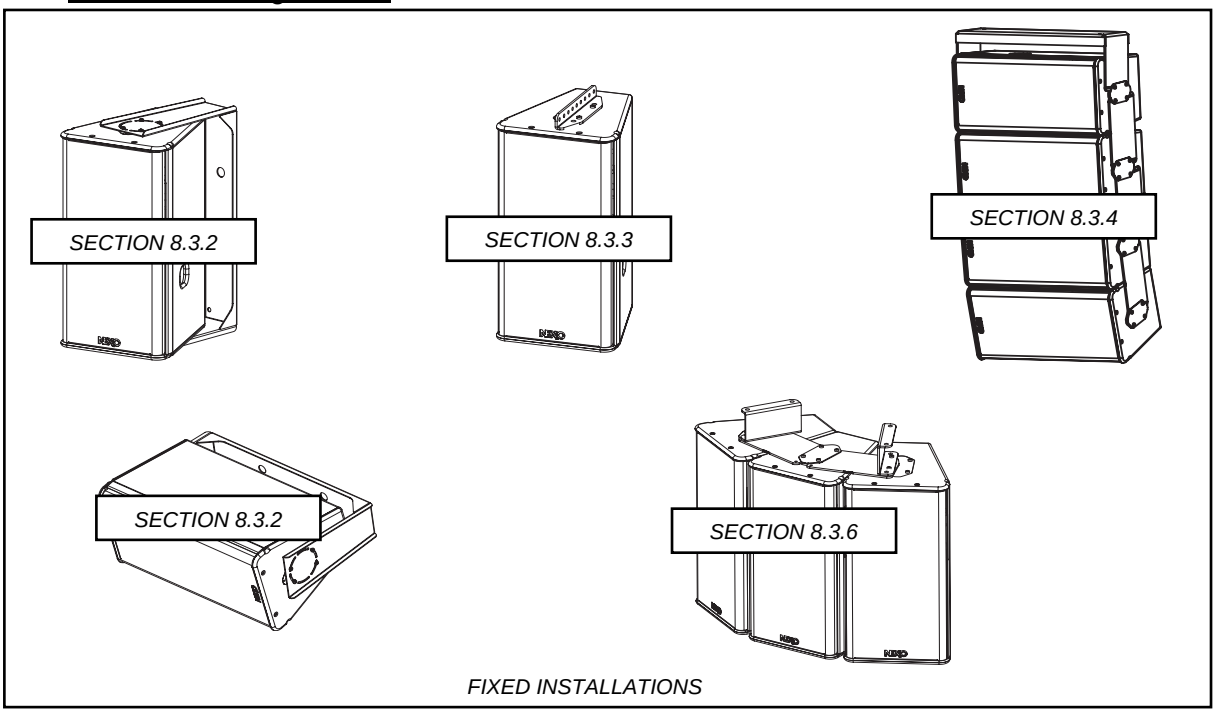


GEO S12 CONNECTING PLATES

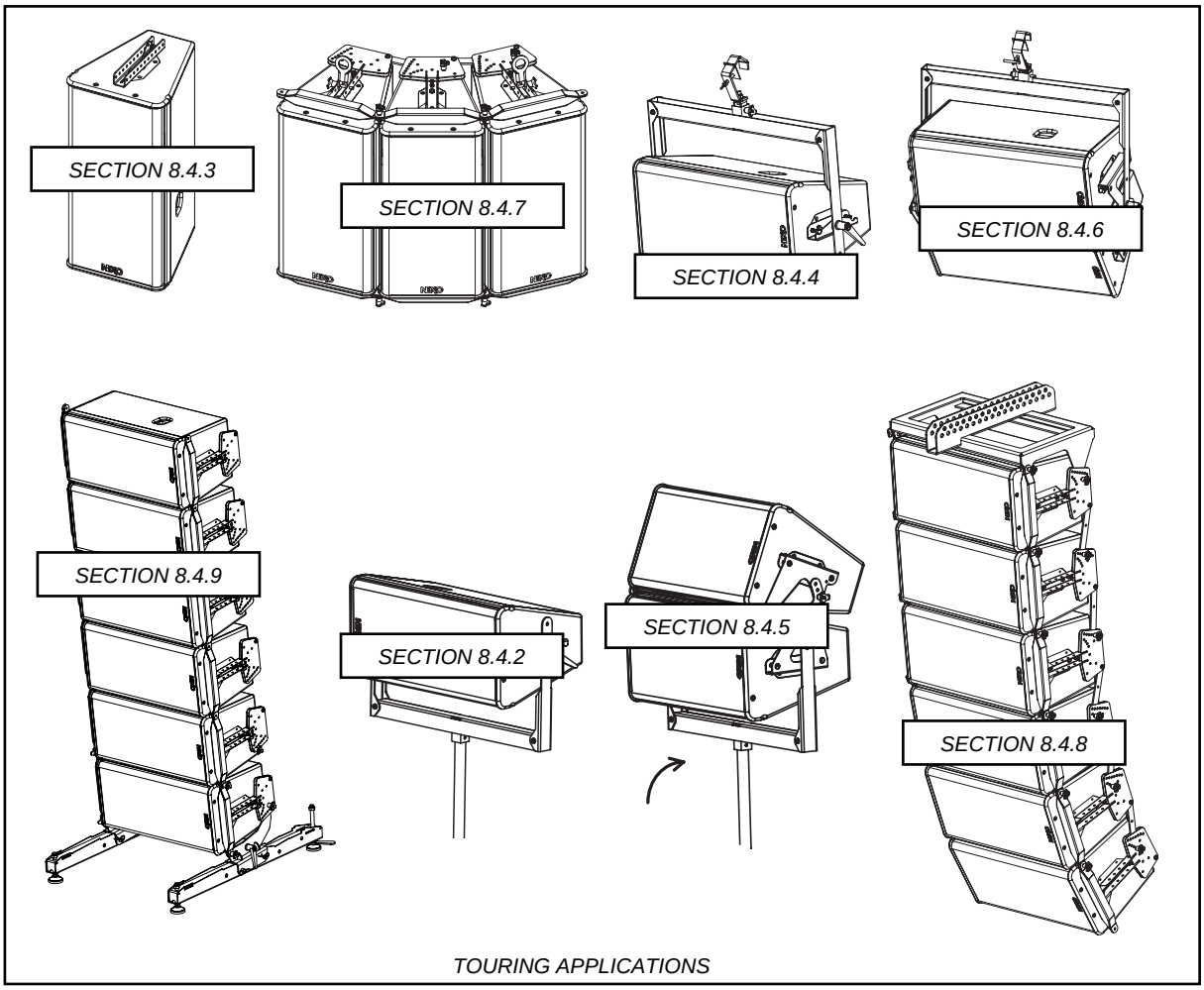
There are two families of accessories:

- fixed installation accessories, which are designed to be screwed on the connecting plates;
- touring accessories, which can be installed or removed with a quick connecting system.

8.2.1 Described configurations



FIXED INSTALLATIONS



TOURING APPLICATIONS

8.2.2 WARNINGS ON GEO S12 ACCESSORIES

WARNING 1T

All GEO S12 Accessories are specifically rated in agreement with structural computations.

Never use other accessories – including push-pins - when assembling GEO S12 cabinets than the ones provided by NEXO: NEXO will decline responsibility over the entire GEO S12 accessory range if any component is purchased from different supplier.

WARNING 2

For SAFETY reasons, following first generation accessories:

- **GEOS12-XBOW**
- **GEOS12-TCBRK**
- **GEOS12-SSBRK**
- **GEOS12-PSBRK**
- **GEOS12-TTC**

Have been recalled in August 2007 and MUST NO LONGER BE USED

These accessories have been replaced by:

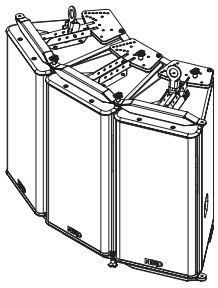
- **GEOS12-XBOW-V2**
- **GEOS12-TCBRK-V2**
- **GEOS12-SSBRK-V2**
- **GEOS12-PSBRK-V2**
- **GEOS12-TTC-V2**

Please contact your local distributor if any doubt in relation the GEO S12 accessories you are using.

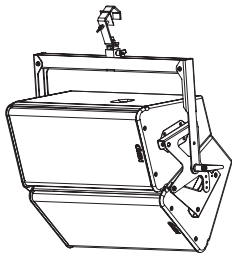
WARNING 3

All GEO S12 accessories have been designed so that cabinets are arrayed in the acoustic coupling plane (adjacent waveguides as shown in figures below).

GEO S12 assemblies in the "non coupling plane" – as shown in figure below- are UNSAFE and STRICTLY PROHIBITED.



YES



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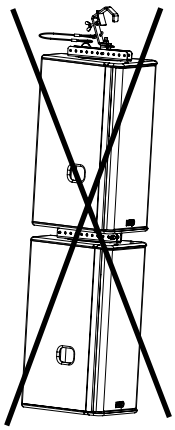


NO

8.3 GEO S12 in fixed installations

8.3.1 Fixed installation Accessories and kits

Accessories are:

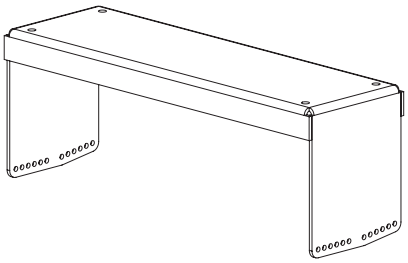
- Bumper (GEOS12-FBUMPER)
- "U" Bracket (GEOS12-UBRK)
- "L" Bracket for cable suspension (GEOS12-LBRK)
- "U" Bracket for rigid suspension (GEOS12-ABRK)
- Connecting Plates / range : 0.20° - 3.15° (GEOS12-ANPL1)
- Connecting Plates / range : 5.00° - 10.0° (GEOS12-ANPL2)
- Connecting Plates / range : 16.0° - 30.0° (GEOS12-ANPL3)

Please refer to section 13.4 of this manual for more information of above references.

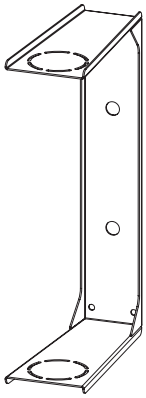
IMPORTANT

In order to prevent screws from getting loose in fixed installations, use blocking liquid LOCTITE™ 243 or equivalent for all screws used with GEO S12 fixed installation accessories.

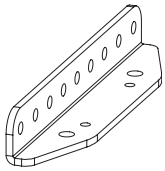
LOCTITE™ 243 is available at NEXO or at your local distributor upon request.



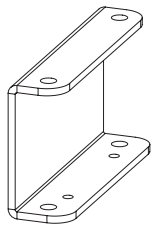
GEOS12-FBUMPER



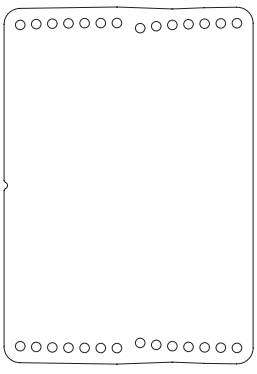
GEOS12-UBRK



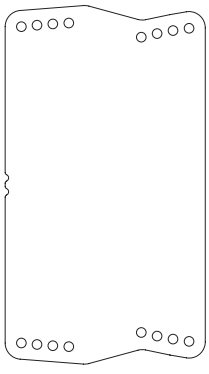
GEOS12-LBRK



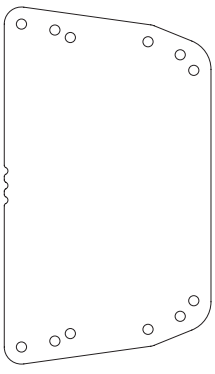
GEOS12-ABRK



GEOS12-ANPL1



GEOS12-ANPL2



GEOS12-ANPL3

8.3.2 Single GEO S12 rigidly mounted on a wall or a ceiling (vertical or horizontal)

Required items

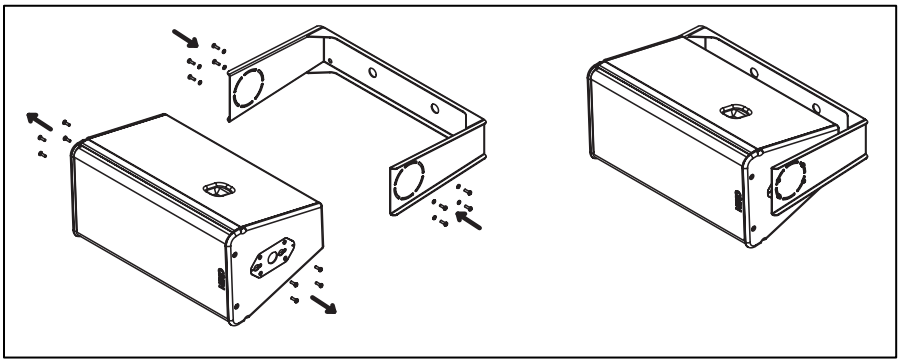
- 1 x GEOS12-UBRK (allows all angles to be implemented)
- 4 x 12mm diameter screws (*not provided*)

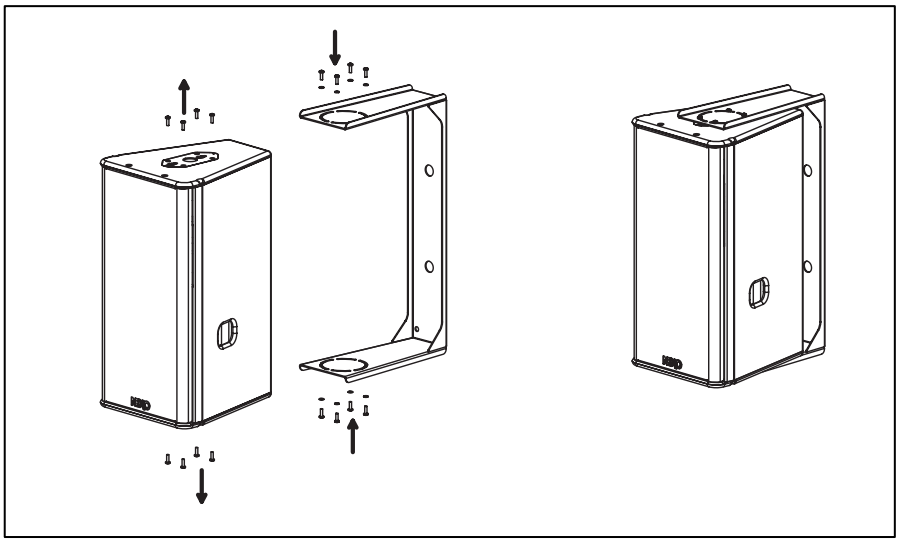
IMPORTANT

Ensure that the surface – wall or ceiling – is strong enough to hold GEO S12 weight and that the for screws 12mm diameter and corresponding plugs required to fix the "U" bracket on the wall or under the ceiling are properly dimensioned.

Procedure

- For screws 12mm diameter (not provided) are required to secure the "U" Bracket on the wall or ceiling;
- Remove the four TORX screws holding connector plates on both sides of GEO S12;
- Fill each screw hole with Locktite 243 or equivalent;
- Position the GEO S12 inside the "U" Bracket to desired angle; "U" bracket oblong holes must be properly aligned with panels holes;
- Use the eight screws and washers from GEOS12-UBRK kit to connect "U" bracket to cabinet.





8.3.3 Single GEO S12 cable mounted on a wall or a ceiling (vertical or horizontal)

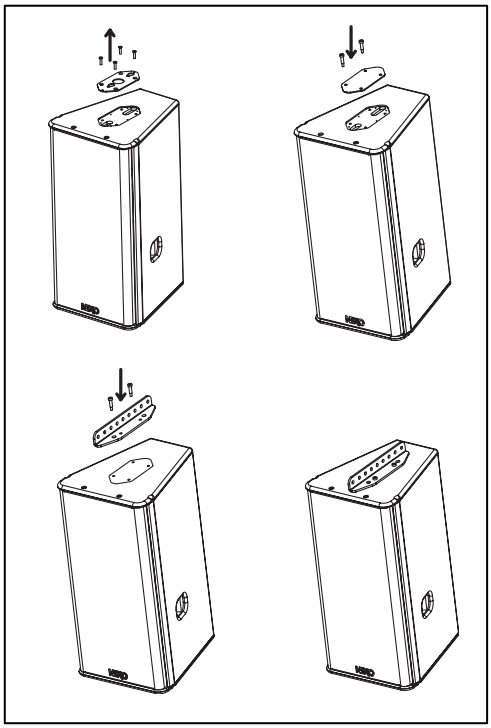
Required items

- 1 or 2 x GEOS12-LBRK (allows cable suspension, holes for cable suspension are 10mm diameter);
- 2 or 4 slings and corresponding shackles (not provided)

IMPORTANT

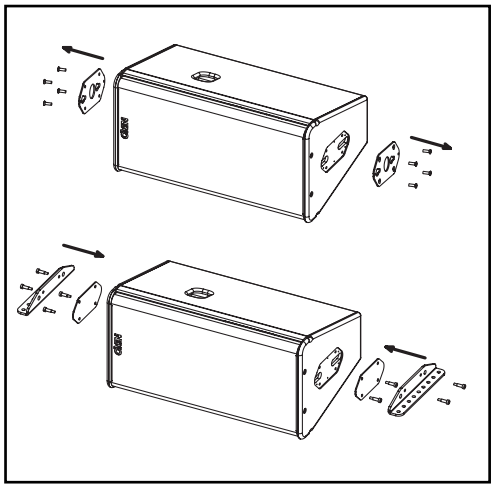
Ensure that the ceiling is strong enough to hold GEO S12 weight and that the cable suspension system required to install the cabinet under the ceiling is properly dimensioned.

Procedure



Vertical

- Remove the four TORX screws holding connector plate on upper side of GEO S12;
- Remove the connector plate from Geo S12;
- Fill each screw hole with Locktite 243 or equivalent;
- Position external plate from GEOS12-LBRK kit and secure it using the 2 of the 4 shoulder screws supplied with this kit;
- Position “L” bracket from GEOS12-LBRK kit, and secure it to the cabinet using the 2 remaining shoulder screws supplied with this kit.
- Slings and shackles (not provided) are required to secure the cluster under the ceiling;



Horizontal

- Remove the four TORX screws holding connector plates on both side of GEO S12;
- Remove the connector plates from Geo S12;
- Fill each screw hole with Locktite 243 or equivalent;
- Position external plates from GEOS12-LBRK kits and secure them using the shoulder screws supplied with these kits;
- Position “L” brackets from GEOS12-LBRK kits, and secure them to the cabinet using the 4 remaining shoulder screws supplied with these kits.
- Slings and shackles (not provided) are required to secure the cluster under the ceiling;

8.3.4 GEO S12 vertical array rigidly mounted on a ceiling

Required items

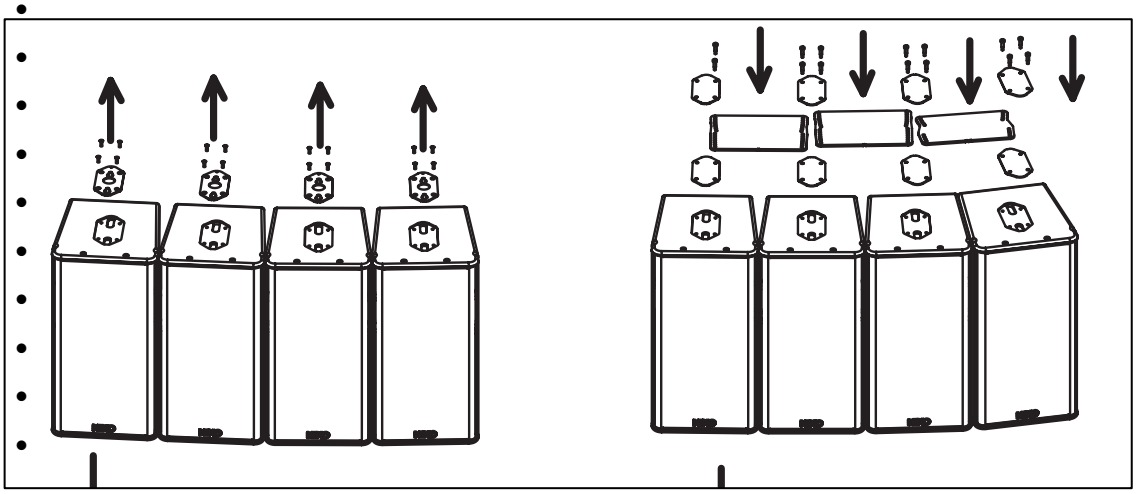
- 1 x GEOS12-FBUMPER (allows +/-5° bumper tilt when installed below a flat surface; if higher bumper tilt is required, surface will have to be defined accordingly) ;
- (N-1) x GEOS12-ANPL for a N x GEO S12 array (ANPL1 ranges from 0.2° to 3.15°, ANPL2 ranges from 5° to 10°, ANPL3 ranges from 16° to 30°)
- Four 12mm diameter screws (*not provided*)

IMPORTANT

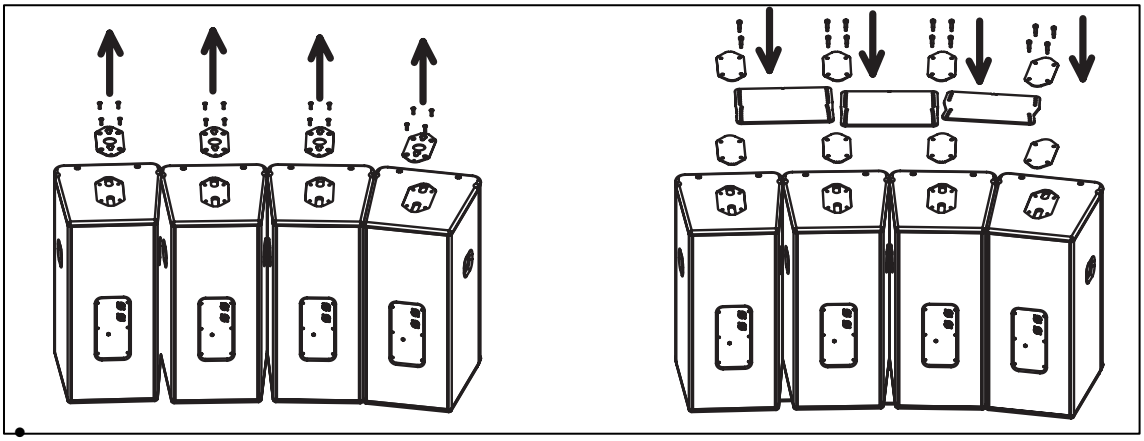
Ensure that the ceiling is strong enough to hold GEO S12 cluster weight and that the four screws 12mm diameter and corresponding plugs required to fix the bumper under the ceiling are properly dimensioned.

Procedure

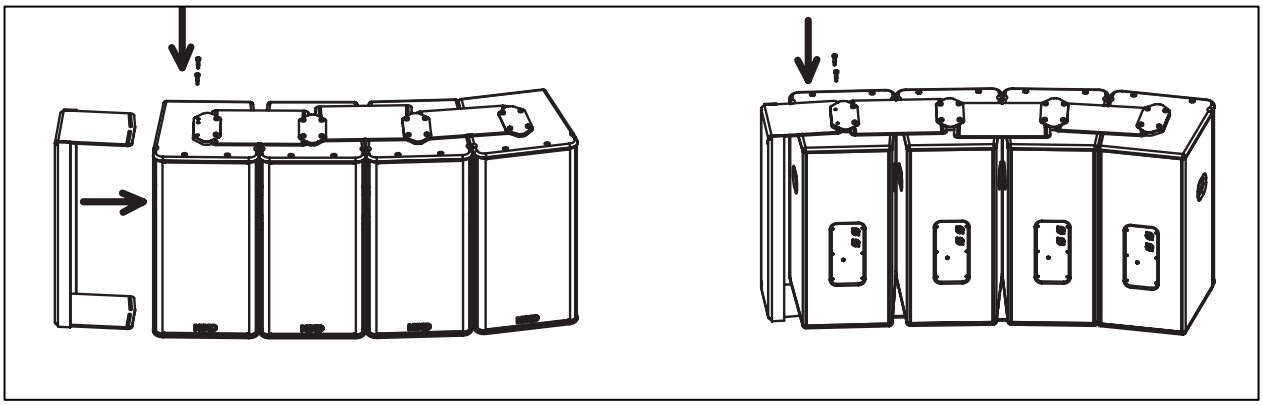
- (1) Set all GEO S12 side by side;
- (2) Remove the four TORX screws holding connector plates on upper side of all GEO S12's;
- (3) Remove the connector plates from all Geo S12's;
- (4) Fill each screw hole with Locktite 243 or equivalent;
- (5) Position bottom external plates, angle plates and top external plate from GEOS12-ANPL kit to required inter-cabinet angle value between cabinets upper sides;
- (6) Screw all shoulder screws from GEOS12-ANPL kits so that all plates and cabinets are tightened together;

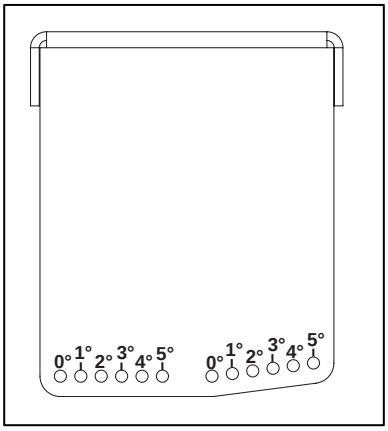


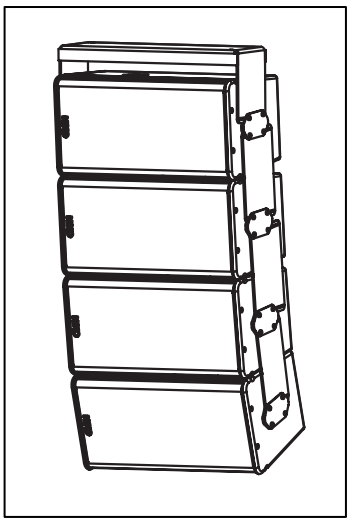
- (7) Flip the cluster upside down to access connector plates located on the down side;
- (8) Repeat all above steps from #2 to #6;



- (9) Position the GEOS12-FBUMPER bumper to required angle position and use the four shoulder screws from GEOS12-FBUMPER kit to connect it the bumper to the top cabinet;







- (10) Flip GEO S12 cluster by 90° so that it is ready to be positioned under the ceiling;
- (11) Four screws 12mm diameter (not provided) are required to secure the bumper under the ceiling.

8.3.5 GEO S12 vertical array cable mounted on a ceiling

Required items

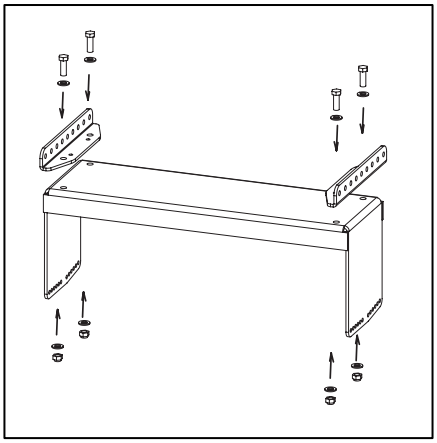
- 1 x GEOS12-FBUMPER;
- 2 x GEO S12-LBRK (allows cable suspension for bumper, holes for cable suspension are 10mm diameter);
- (N-1) x GEOS12-ANPL for a N x GEO S12 array (ANPL1 ranges from 0.2° to 3.15°, ANPL2 ranges from 5° to 10°, ANPL3 ranges from 16° to 30°)
- 4 slings and shackles (not provided)

IMPORTANT

Ensure that the ceiling is strong enough to hold GEO S12 cluster weight and that the cables suspension system required fixing the bumper under the ceiling is properly dimensioned.

Procedure

- Connect the bumper and the two “L” brackets using the screws, washers and bolts provided in the GEO S12-LBRK kit;



- Proceed as in preceding section;
- 4 slings and 4 shackle (not provided) are required to secure the cluster under the ceiling;

8.3.6 GEO S12 horizontal array rigidly mounted on a ceiling

Required items

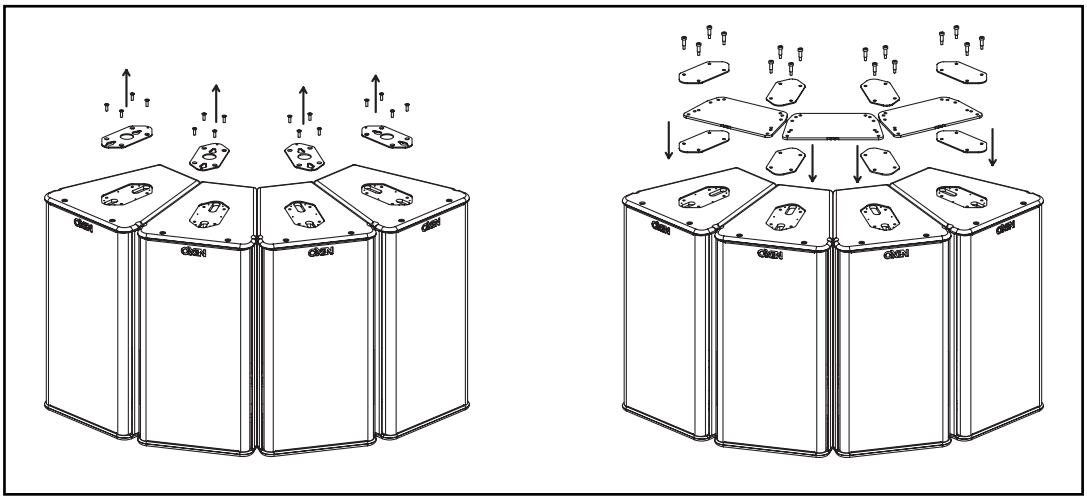
- 2 x GEO S12-ABRK (allows rigid ceiling suspension for horizontal arrays)
- (N-1) x GEOS12-ANPL for a N x GEO S12 array (ANPL1 ranges from 0.2° to 3.15°, ANPL2 ranges from 5° to 10°, ANPL3 ranges from 16° to 30°)
- Four 12mm diameter screws (*not provided*)

IMPORTANT

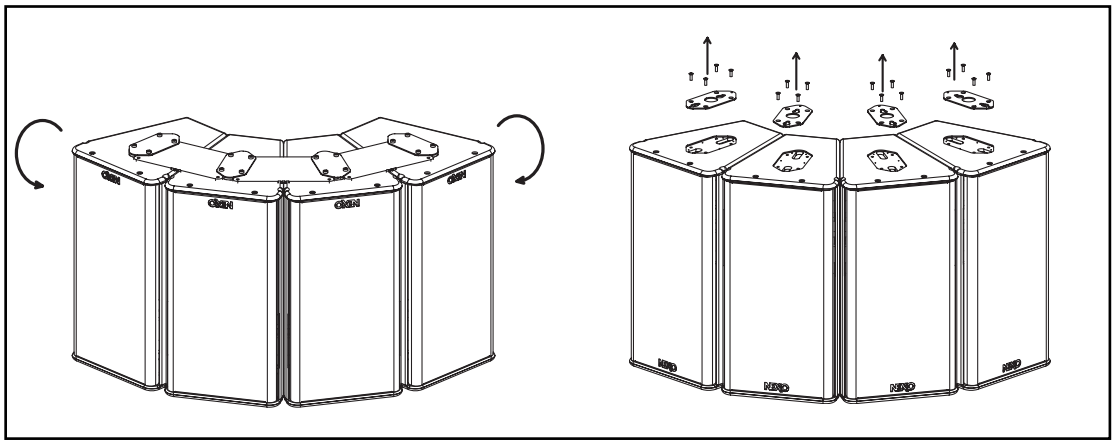
Ensure that the ceiling is strong enough to hold GEO S12 cluster weight and that the four screws 12mm diameter and corresponding plugs required to fix the "L" brackets under the ceiling are properly dimensioned.

Procedure

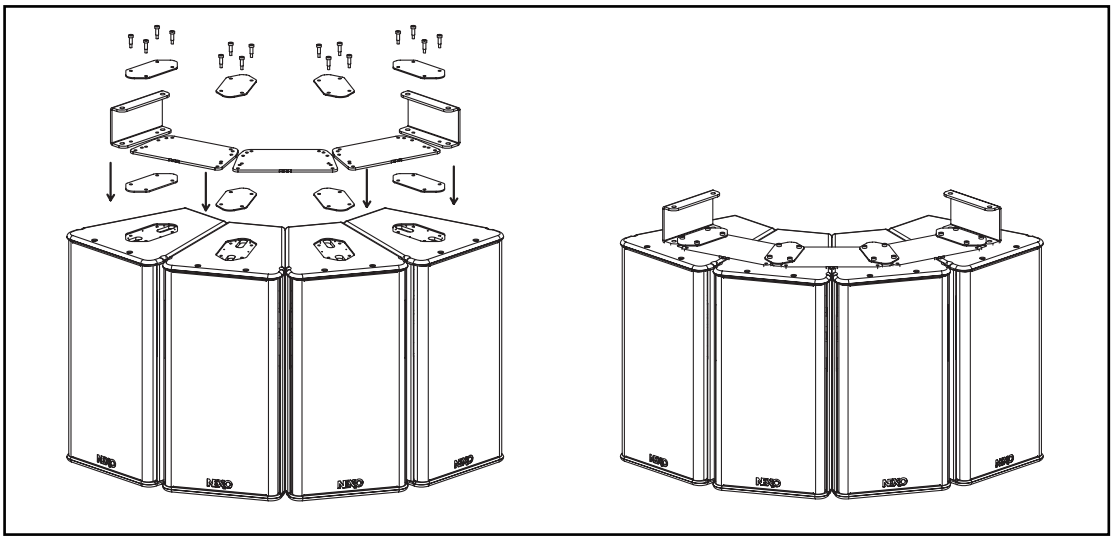
- (1) Set all GEO S12 side by side;
- (2) Remove the four TORX screws holding connector plates on upper side of all GEO S12's;
- (3) Remove the connector plates from all Geo S12's;
- (4) Fill each screw hole with Locktite 243 or equivalent;
- (5) Position bottom external plates, angle plates and top external plate from GEOS12-ANPL kit to required inter-cabinet angle value between cabinets upper sides;
- (6) Screw all shoulder screws from GEOS12-ANPL kits so that all plates and cabinets are tightened together;



- (7) Flip the cluster upside down to access connector plates located on the down side;
- (8) Repeat all above steps from #2 to #6;



- (9) Position the two “U” brackets from GEOS12-ABRK kits on the outer cabinets next the angle plates, and tight them to the cabinets using the shoulder screws provided with these kits,
- (10) Four screws 12mm diameter (not provided) are required to secure the “U” brackets under the ceiling;



8.3.7 GEO S12 horizontal array cable mounted on a ceiling

Required items

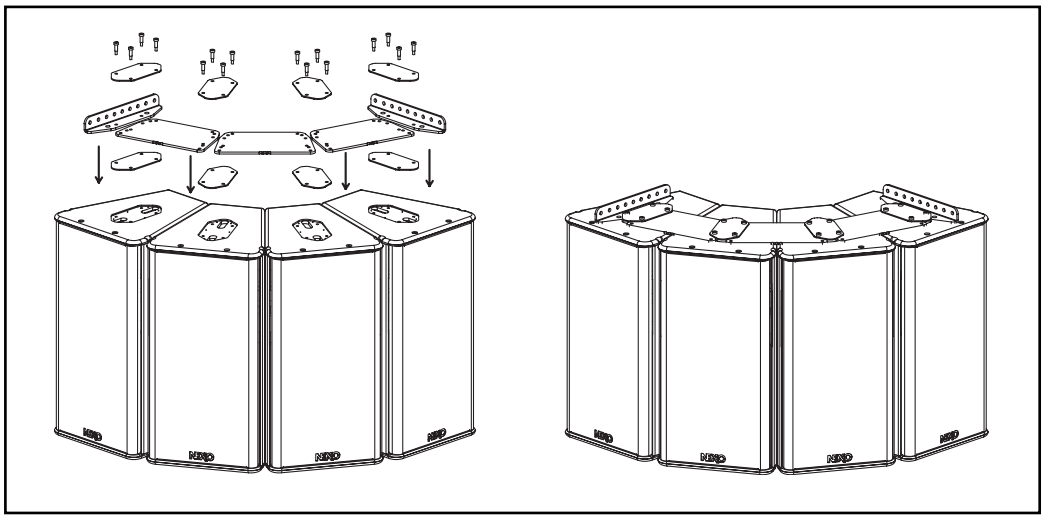
- 2 x GEO S12-LBRK (allows cable suspension for horizontal arrays, holes for cable suspension are 10mm diameter);
- (N-1) x GEOS12-ANPL for a N x GEO S12 array (ANPL1 ranges from 0.2° to 3.15°, ANPL2 ranges from 5° to 10°, ANPL3 ranges from 16° to 30°)
- 4 slings and 4 shackles (not provided).

IMPORTANT

Ensure that the ceiling is strong enough to hold GEO S12 cluster weight and that the cables suspension system required fixing the cluster under the ceiling is properly dimensioned.

Procedure

- Proceed as in above section, GEOS12-LBRK being positioned on the outer cabinets instead of GEOS12-ABRK.
- 4 slings and 4 shackle (not provided) are required to secure the cluster under the ceiling;



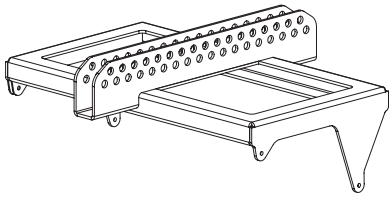
8.4 GEO S12 in touring applications

8.4.1 Touring Accessories

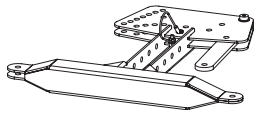
Accessories are :

- Bumper (GEOS12-BUMPER)
- Rigging Plates (GEOS12-XBOW-V2)
- Tension Mode Link Bars for GEOS12-XBOW-V2 (GEOS12-TLB)
- Lifting Ring for GEOS12-SSBRK, GEOS12-PSBRK or GEOS12-TTC (GEOS12-XHBRK)
- Truss hook for GEOS12-SSBRK, GEOS12-PSBRK or GEOS12-TTC (GEOS12-TCBRK-V2)
- “U” Bracket for single horizontal GEO S12 on pole stand, lifting ring or truss hook (GEOS12-SSBRK-V2)
- U” Bracket for two horizontal GEO S12 on pole stand, lifting ring or truss hook (GEOS12-PSBRK-V2)
- Flying Bar for single vertical GEO S12 (GEOS12-TTC-V2)
- Ground Stacking device for up to 6 GEOS1210 (GEOS12-GSTK)

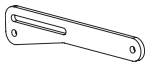
Please refer to section 13.3 of this manual for more information of above references.



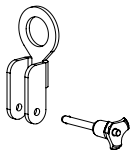
GEOS12- BUMPER



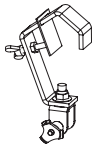
GEOS12-XBOW-V2



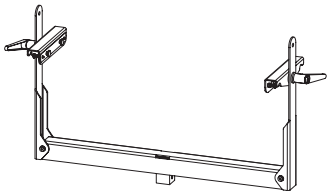
GEOS12-TLB



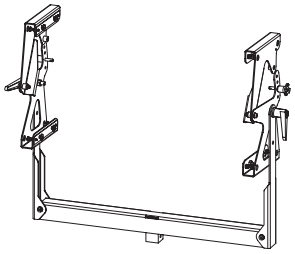
GEOS12-XHBRK



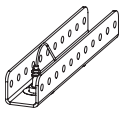
GEOS12-TCBRK-V2



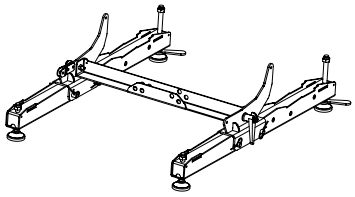
GEOS12-SSBRK-V2



GEOS12-PSBRK-V2



GEOS12-TTC-V2



GEOS12-GSTK

8.4.2 Single GEO S12 on speaker stand or on RS15 horizontally

Required items

- 1 x "U" Bracket for single horizontal GEO S12 (GEOS12-SSBRK-V2);
- 1 x Speaker stand diameter 35mm (K&M 213 or equivalent);
- Or NEXO PS pole stand (STDPS) for mounting on top of RS15

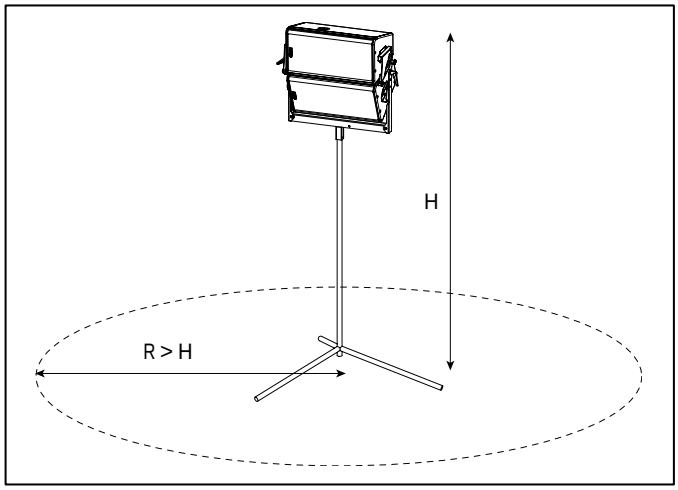
IMPORTANT (SPEAKER STAND)

- Speaker stand must be rated for assembly weight (40kg rated load min);

- Speaker stand must always be installed on a horizontal surface;

- Stand height and footprint must be defined to prevent assembly from collapsing;

- Ensure that public is not allowed within a safety area which radius is equal or higher than assembly height.



IMPORTANT (RS15 POLE STAND)

- NEXO STDPS pole stand only should be used for mounting on top of NEXO RS15

- If 2 RS15s are to be stacked below GEO S12s pole mounted, they should be connected together through use of RS15 rigging plates;

- RS15s must always be installed on a horizontal surface;

- Ensure that public is not allowed within a safety area which radius is equal or higher than assembly height.

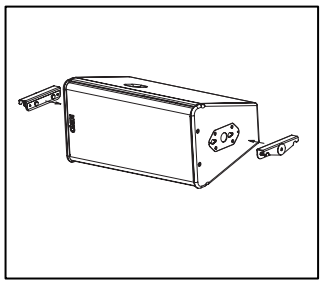
Procedure

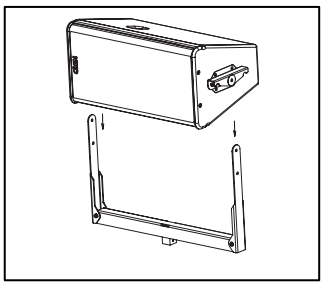
- Slide GEOS12-SSBRK-V2 side plates into GEO S12 connecting plate oblong holes;
- Lock safety pins into GEO S12 connecting plate;

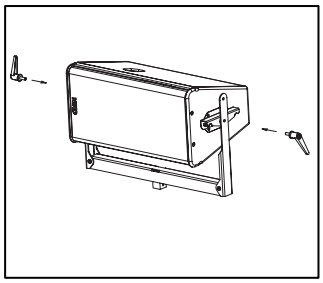
IMPORTANT

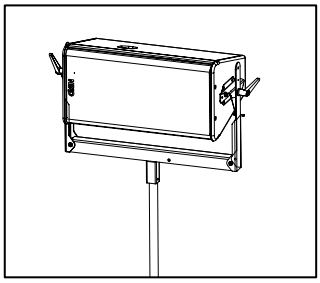
Ensure that safety pins are properly locked into GEO S12 connecting panels.

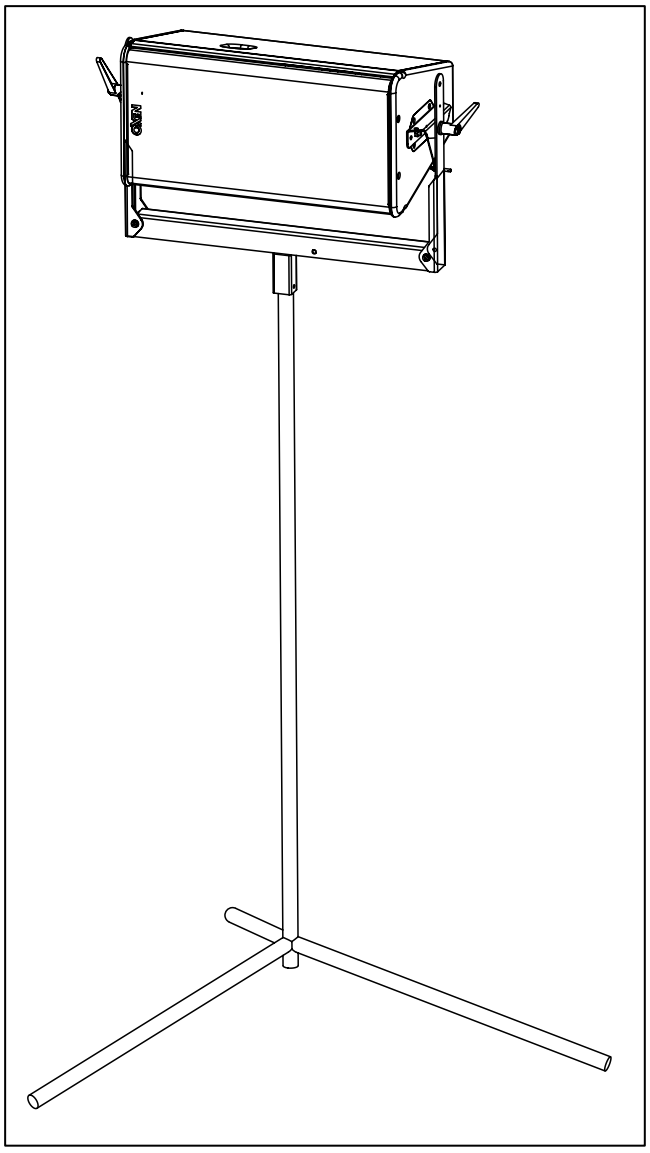
- Position "U" bracket over these side plates; align centre holes;
- Insert adjustment handles, adjust vertical angle and tight the handles to prevent GEO S12 from rotating around "U" bracket;
- Lift assembly on speaker stand or on RS15 with STDPS pole stand.

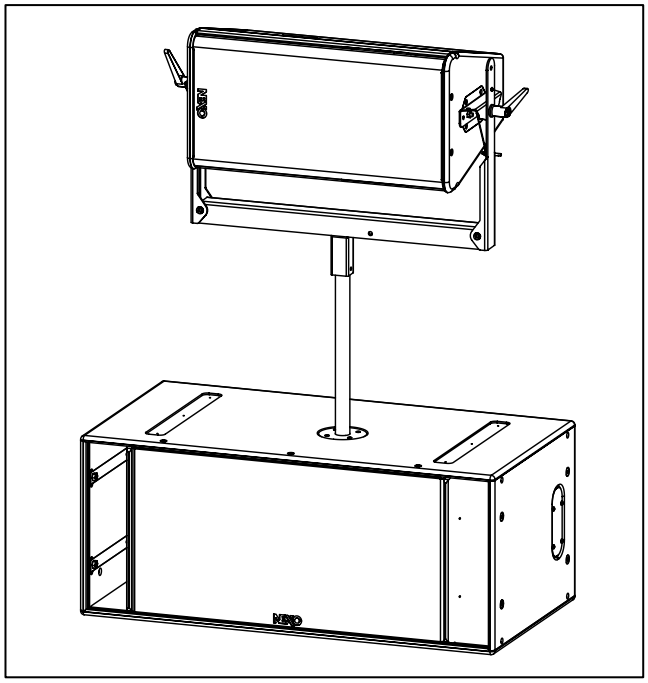












8.4.3 Single GEO S12 flown vertically

Required items

- 1 x Flying Bar for single vertical GEO S12 (GEOS12-TTC-V2)
- 1 x Lifting Ring (GEOS12-XHBRK)
- Or 1 x Truss hook (GEOS12-TCBRK-V2)

IMPORTANT

Ensure that truss suspension point is strong enough to hold GEO S12 weight.

Procedure

- Slide flying bar GEOS12-TTC-V2 into GEO S12 connecting plate oblong holes;
- Lock safety pin into GEO S12 connecting plate;

IMPORTANT

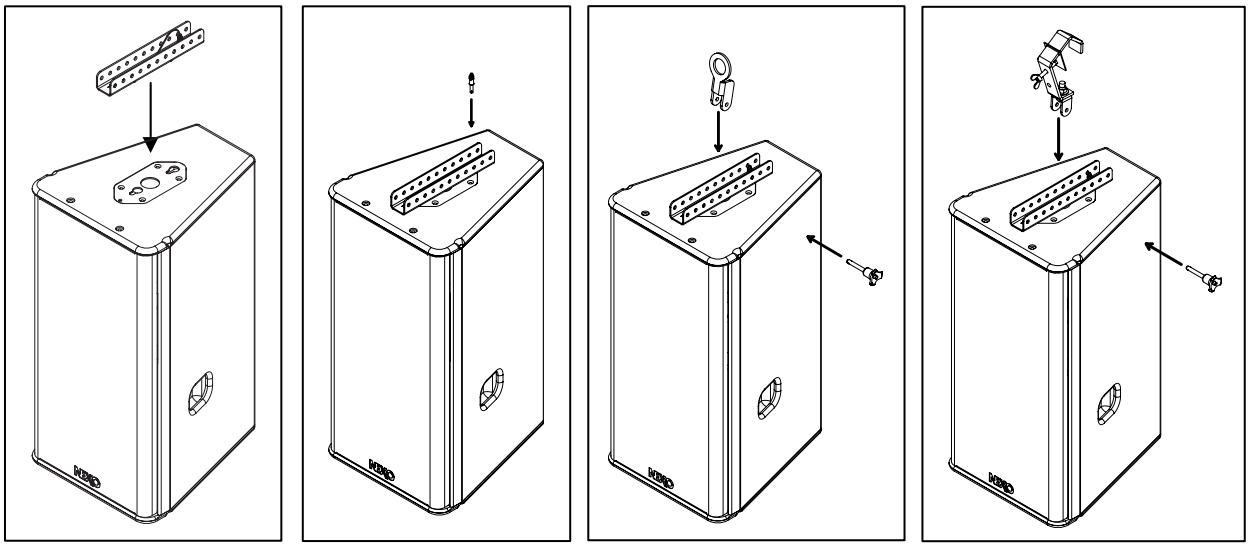
Ensure that safety pin is properly locked into GEO S12 connecting panel.

Cable suspension:

- Connect lifting ring GEOS12-XHBRK to flying bar by inserting 8x45 quick release pin in required holes for proper vertical aiming;
- Ensure lifting ring is properly locked to flying bar;
- Connect assembly to suspension point with sling and shackle (not provided).

Truss suspension

- Connect truss hook GEOS12-TCBRK-V2 to flying bar by inserting 8x45 quick release pin in required holes for proper vertical aiming;
- Ensure truss hook is properly locked to flying bar;
- Lift and position assembly, lock hook on truss suspension point and secure with hook cable.



8.4.4 Single GEO S12 flown horizontally

Required items

- 1 x “U” Bracket for single horizontal GEO S12 (GEOS12-SSBRK-V2)
- 1 x Lifting Ring (GEOS12-XHBRK)
- Or 1 x Truss hook (GEOS12-TCBRK-V2)

IMPORTANT

Ensure that suspension point is strong enough to hold GEO S12 weight.

Procedure

- Slide GEOS12-SSBRK-V2 side plates into GEO S12 connecting plate oblong holes;
- Lock safety pins into GEO S12 connecting plate;

IMPORTANT

Ensure that safety pins are properly locked into GEO S12 connecting panels.

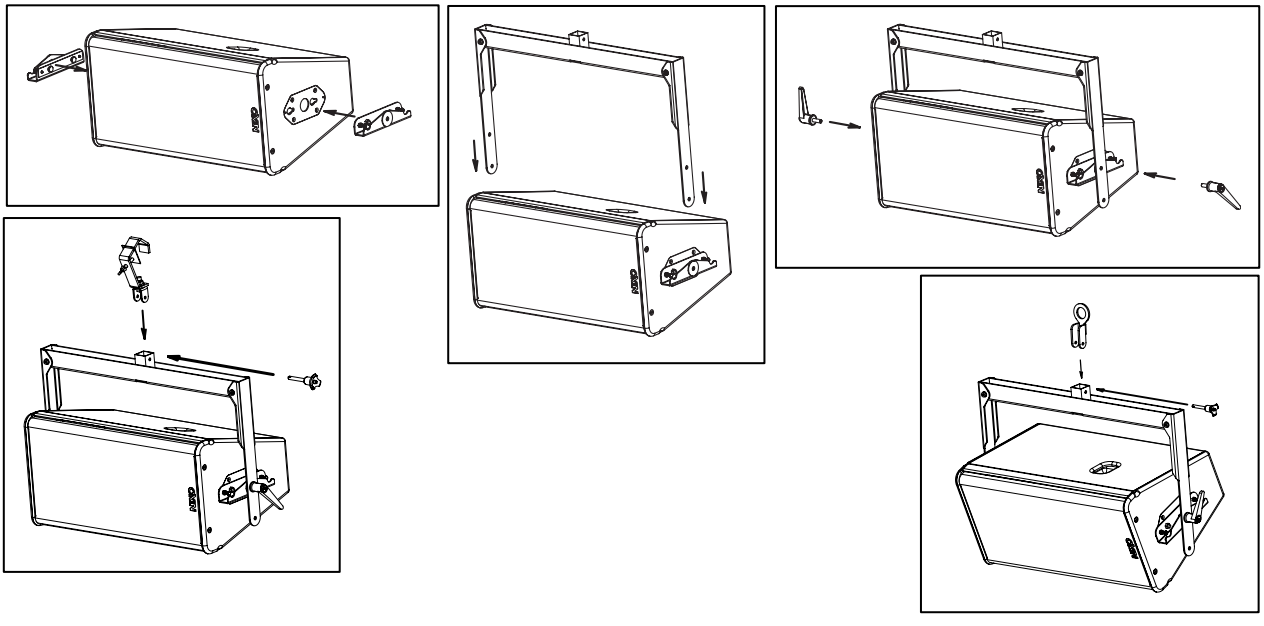
- Position “U” bracket over these side plates; align centre holes;
- Insert adjustment handles, adjust vertical angle and tight the handles to prevent GEO S12 from rotating around “U” bracket;

Cable suspension:

- Connect lifting ring GEOS12-XHBRK to “U” bracket by inserting 8x45 quick release pin dedicated holes;
- Ensure lifting ring is properly locked to “U” bracket;
- Connect assembly to suspension point with sling and shackle (not provided).

Truss suspension

- Connect truss hook GEOS12-TCBRK-V2 to “U” bracket by inserting 8x45 quick release pin in dedicated holes;
- Ensure truss hook is properly locked to “U” bracket;
- Lift and position assembly, lock hook on truss suspension point and secure with hook cable.



8.4.5 Two GEO S12 on wind-up stand or on RS15 horizontally

Required items

- 1 x U" Bracket for two GEO S12 (GEOS12-PSBRK-V2)
- 1 x Wind Up stand diameter 35mm (Eurotruss ES160 or equivalent);
- Or NEXO PS pole stand (STDPS) for mounting on top of RS15

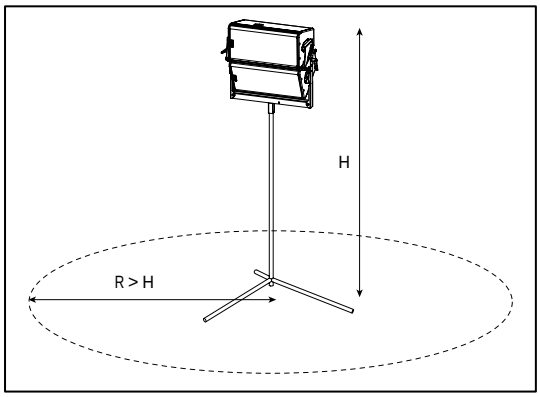
IMPORTANT (WIND UP STAND)

- Wind Up stand must be rated for assembly weight (80kg rated load min);

- Wind Up stand must always be installed on a horizontal surface;

- Stand height and footprint must be defined to prevent assembly from collapsing;

- Ensure that public is not allowed within a safety area which radius is equal or higher than assembly height.



IMPORTANT (RS15 POLE STAND)

- NEXO STDPS pole stand only should be used for mounting on top of NEXO RS15

- If 2 RS15s are to be stacked below GEO S12s pole mounted, they should be connected together through use of RS15 rigging plates;

- RS15s must always be installed on a horizontal surface;

- Ensure that public is not allowed within a safety area which radius is equal or higher than assembly height.

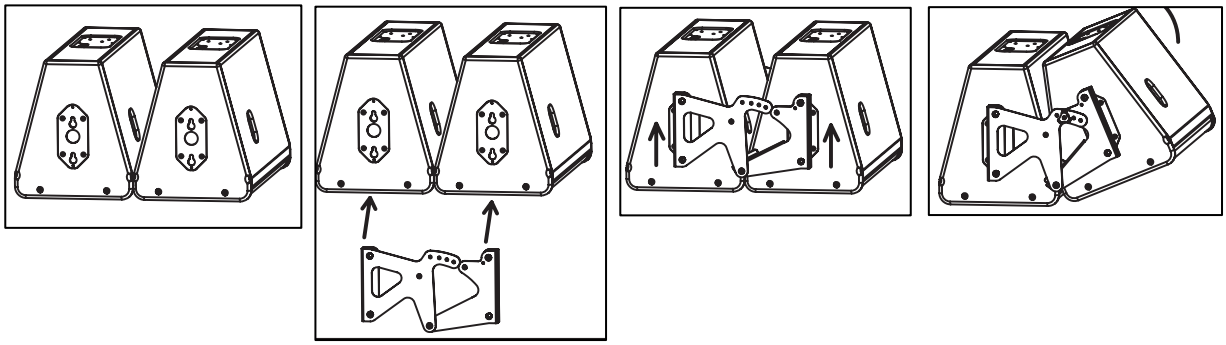
Procedure

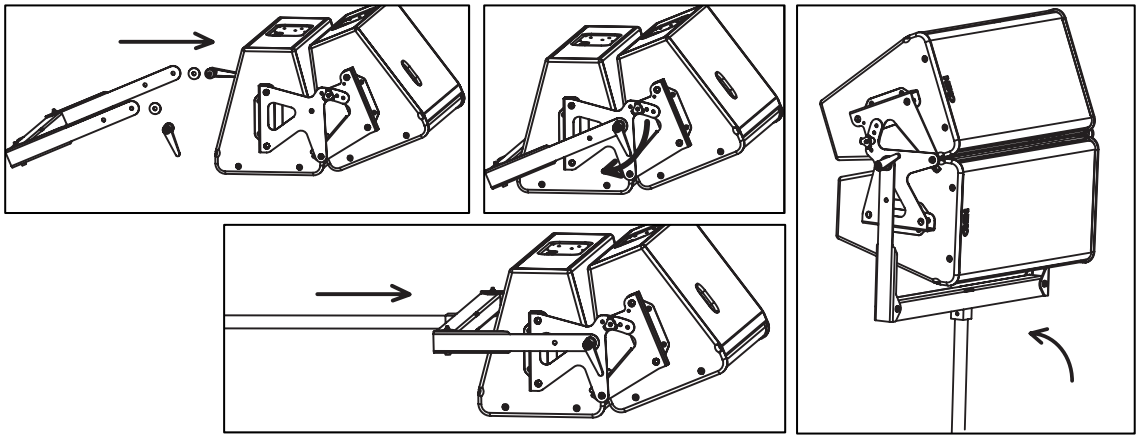
- Set the 2 GEO S12 next to each other front grid to the floor
- Slide GEOS12-PSBRK-V2 side plates into GEO S12s connecting plate oblong holes;
- Lock safety pins into GEO S12s connecting plate;

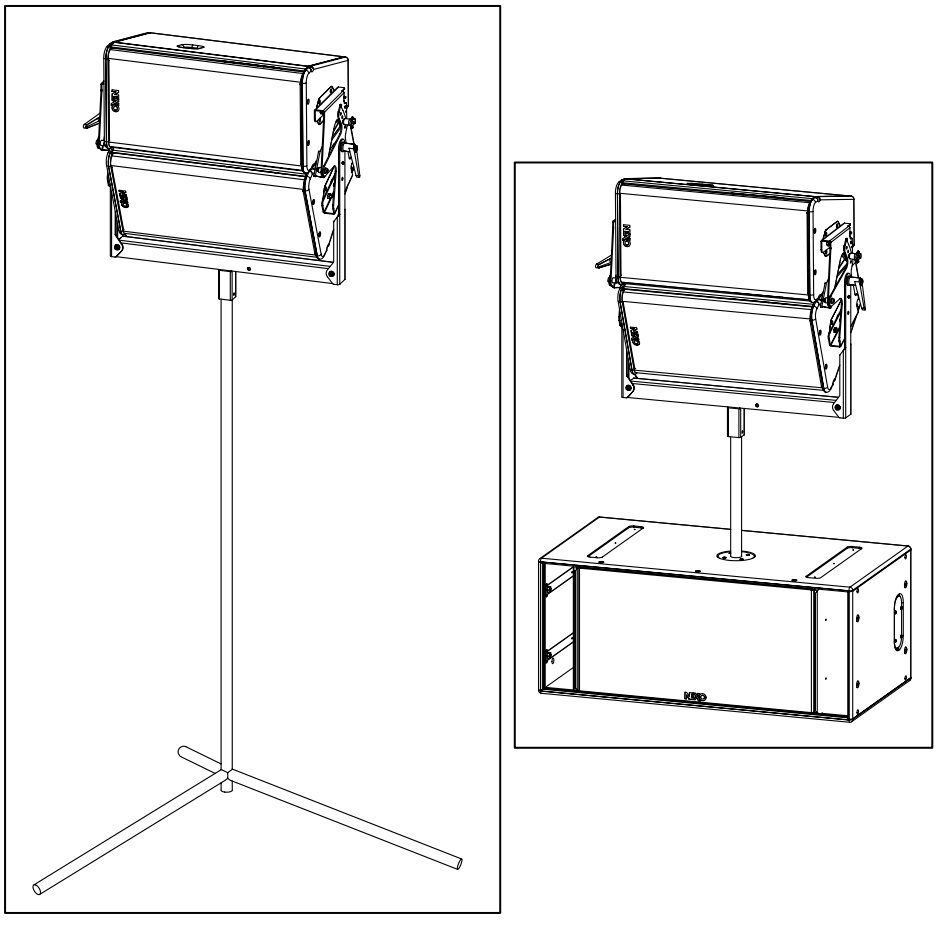
IMPORTANT

Ensure that safety pins are properly locked into GEO S12s connecting panels.

- Adjust inter-cabinet angle and lock to required angle value with 8x20quick release pins;
- Position "U" bracket over these side plates; align centre holes;
- Insert adjustment handles, adjust vertical angle and tight the handles to prevent GEO S12s from rotating around "U" bracket;
- Lift assembly on Wind Up stand or on RS15 with STDPS pole stand.







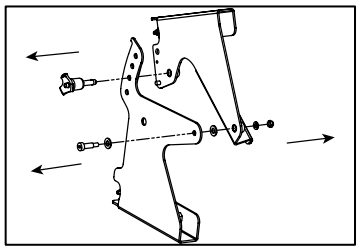
Alternative Procedure ("Walder" procedure)

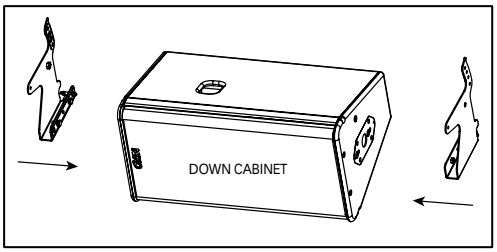
Below described procedure required 2 additional 8x20 quick release pins (BLGEOS)

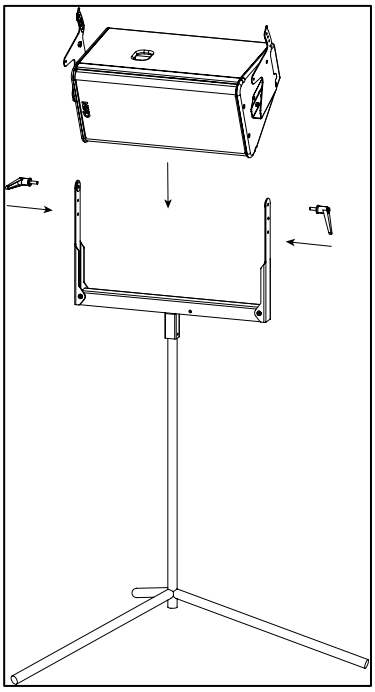
- Split the GEOS12-PSBRK-V2 side plates by removing screws and bolt;
- Slide GEOS12-PSBRK-V2 lower half-plates into lower GEO S12 connecting plate oblong holes;
- Lock safety pins into lower GEO S12 connecting plate;
- Position "U" bracket over these lower half plates; align centre holes;
- Insert adjustment handles, adjust vertical angle and tight the handles to prevent GEO S12 from rotating around "U" bracket;
- Lift assembly on Wind Up stand or on RS15 with STDPS pole stand.
- Slide GEOS12-PSBRK-V2 upper half-plates into upper GEO S12 connecting plate oblong holes;
- Lock safety pins into upper GEO S12 connecting plate;
- Lift upper GEO S12 on top of lower one, and connect them together by inserting 8x20 quick release pins in articulation holes;
- Adjust inter-cabinet angle and lock to required angle value with quick release pins.

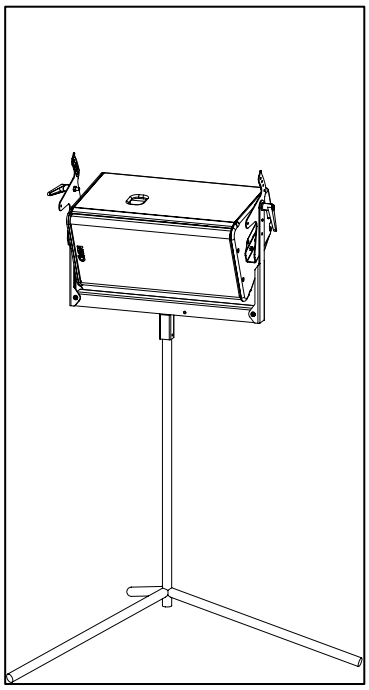
IMPORTANT

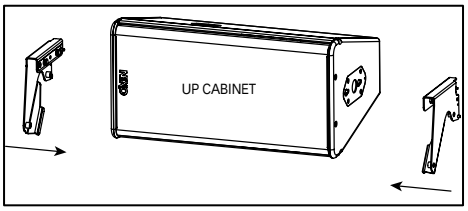
Ensure that safety pins are properly locked into GEO S12 connecting panels.

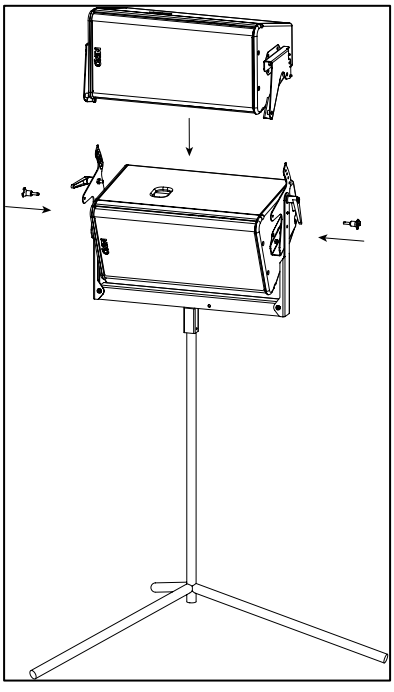


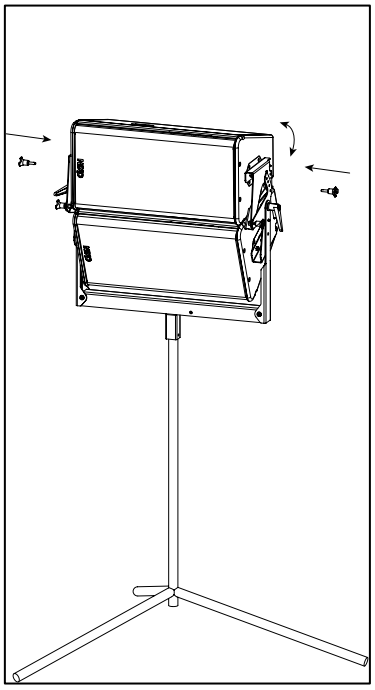

DOWN CABINET

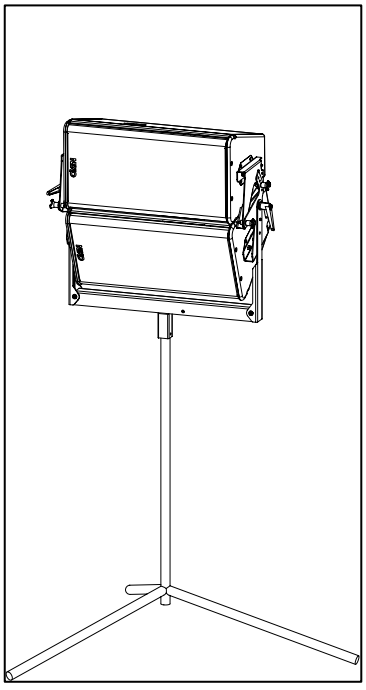





UP CABINET







8.4.6 Two GEO S12 flown horizontally

Required items

- 1 x “U” Bracket for two GEO S12s (GEOS12-PSBRK-V2)
- 1 x Lifting Ring (GEOS12-XHBRK)
- Or 1 x Truss hook (GEOS12-TCBRK-V2)

IMPORTANT

Ensure that suspension point is strong enough to hold two GEO S12s weight.

Procedure

- Slide GEOS12-PSBRK-V2 side plates into GEO S12s connecting plate oblong holes;
- Lock safety pins into GEO S12s connecting plate;

IMPORTANT

Ensure that safety pins are properly locked into GEO S12s connecting panels.

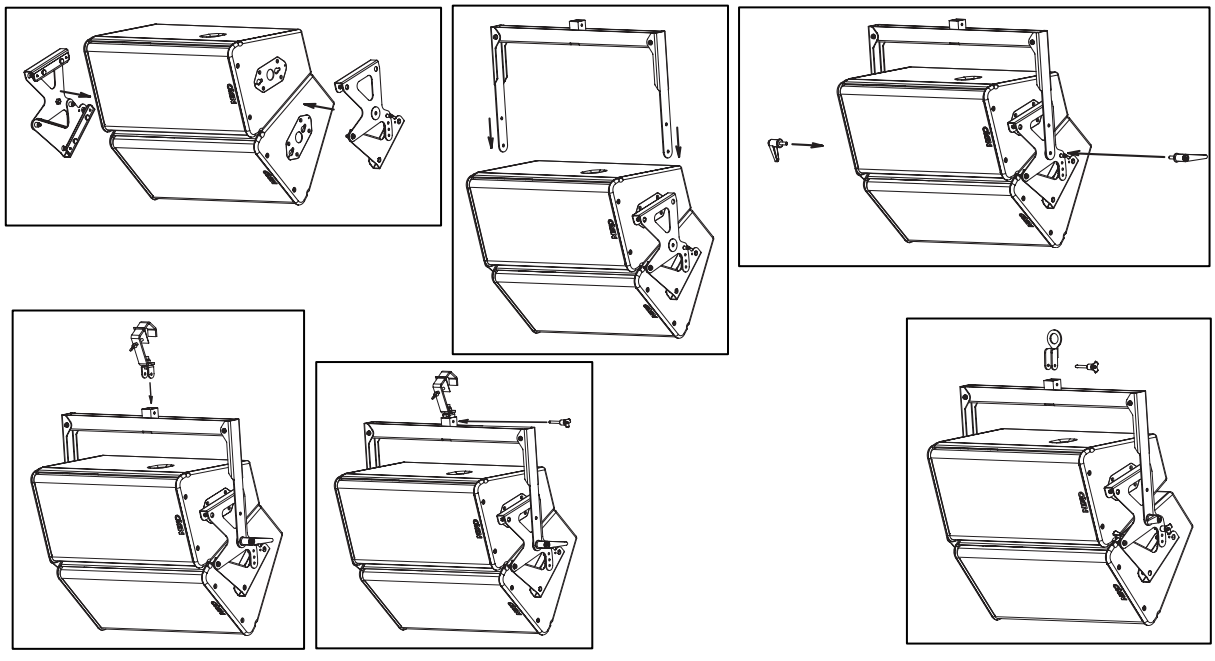
- Adjust inter-cabinet angle and lock to required angle value with 8x20 quick release pins;
- Position “U” bracket over these side plates; align centre holes;
- Insert adjustment handles, adjust vertical angle and tight the handles to prevent GEO S12s from rotating around “U” bracket;

Cable suspension:

- Connect lifting ring GEOS12-XHBRK to “U” bracket by inserting 8x45 quick release pin dedicated holes;
- Ensure lifting ring is properly locked to “U” bracket;
- Connect assembly to suspension point with sling and shackle (not provided).

Truss suspension

- Connect truss hook GEOS12-TCBRK-V2 to “U” bracket by inserting 8x45 quick release pin in dedicated holes;
- Ensure truss hook is properly locked to “U” bracket;
- Lift and position assembly, lock hook on truss suspension point and secure with hook cable.



8.4.7 Two or more GEO S12 flown vertically

Required items

- N Pair of Rigging Plates (GEOS12-XBOW-V2) for N cabinets;
- 1 lifting ring (GEOS12-XHBRK) every two GEO S12;
- 4xN Quick release pins for N cabinets;
- Properly rated slings, shackles, hoists… (not provided)

IMPORTANT

Lifting ring GEOS12-XHBRK and truss hook GEOS12-TCBRK-V2 are rated for a maximum of 2 GEO S12s;

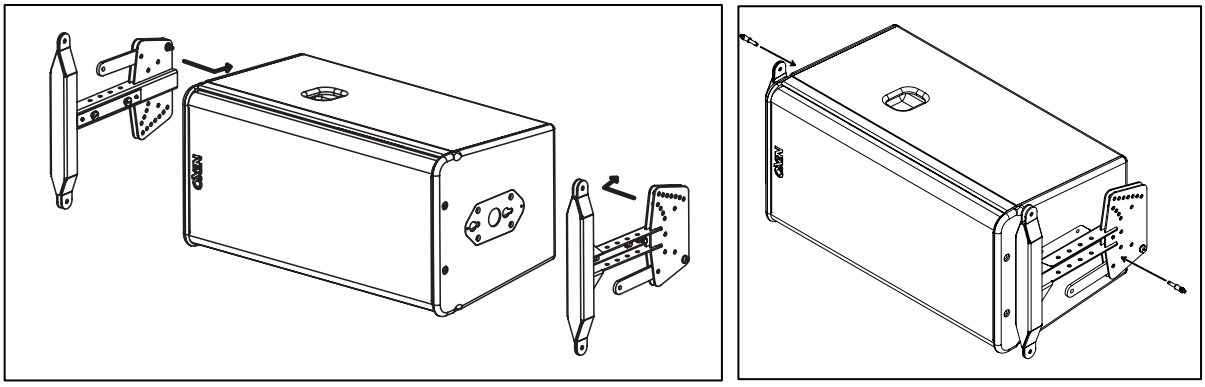
Ensure that suspension points are rated accordingly.

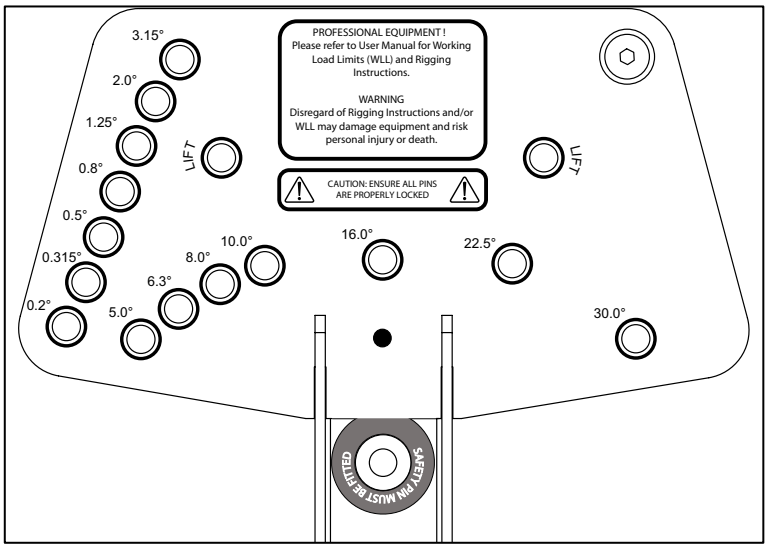
Procedure

- Insert GEOS12-XBOW-V2 into connecting plates of both sides of the cabinet;
- Lock safety pins into GEO S12s connecting plate;

IMPORTANT

Ensure that safety pins are properly locked into GEO S12s connecting panels.





IMPORTANT

GEO S12 can be flown "Up" or "Down" :

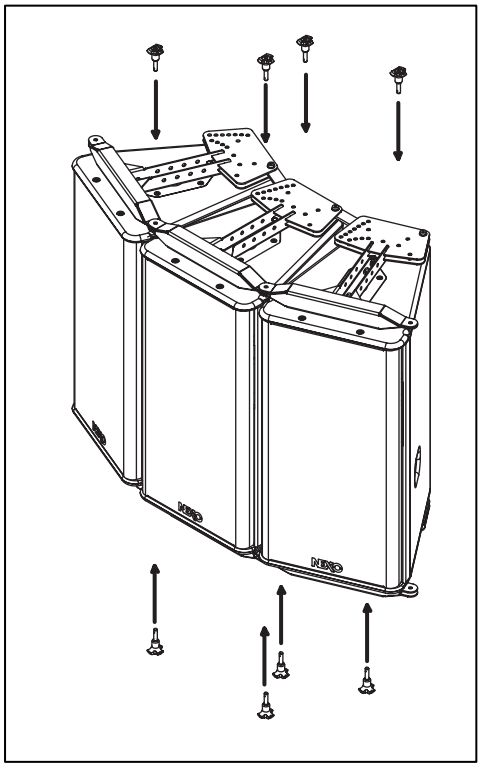
- "Up" means Nexo logo on front grid is at the top;

- "Down" means Nexo logo on front grid is at the bottom.

GEO S12 can be connected "Up" or "Down" by simply flipping the cabinets.

Whenever possible, NEXO recommends symmetrical designs (ie Nexo logo in the same position on Left and Right clusters for stereo designs)

- Connect second Geo S12 with X-Bow front articulation holes and rear link bars and ensure quick release pins are properly locked;
- Repeat above steps for subsequent GEO S12's;



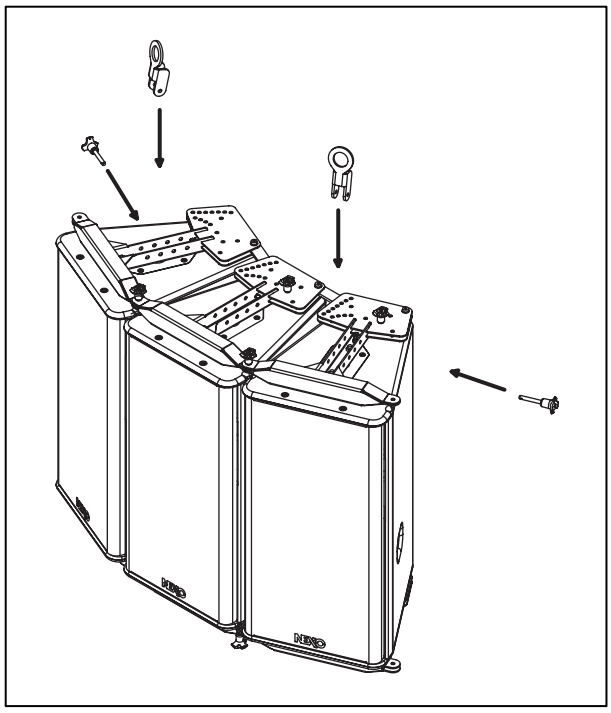
IMPORTANT

Ensure angle settings are identical on upper and lower side of the cabinets

Ensure that safety pins are properly locked into GEO S12s connecting panels.

Ensure that all quick release pins are properly locked into their position.

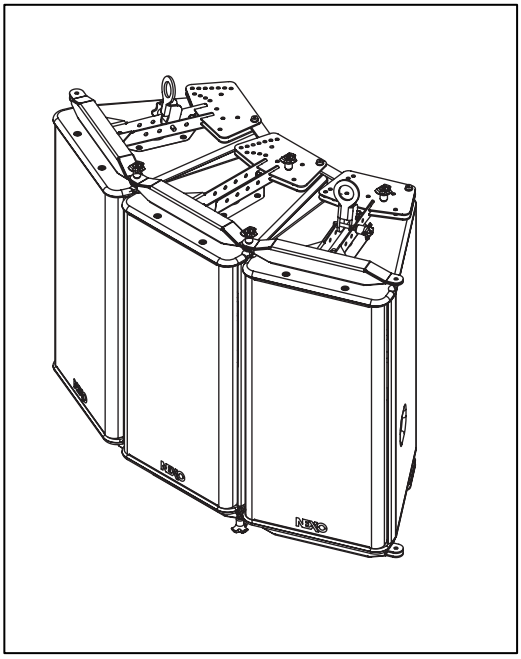
- Connect lifting rings to "U" bracket with 8x45 quick release pins supplied with GEOS12-XHBRK; ensure quick release pin is properly locked;



- Lift and position assembly, connect lifting rings to suspension points with sling and shackle;
- Secure assembly with secondary safety steel.

IMPORTANT

The requirements for secondary safety systems vary with territories. However, the secondary safety steel MUST have a SWL equivalent or greater than that of the rigging system.



8.4.8 Three or more GEO S12 flown horizontally

Required items

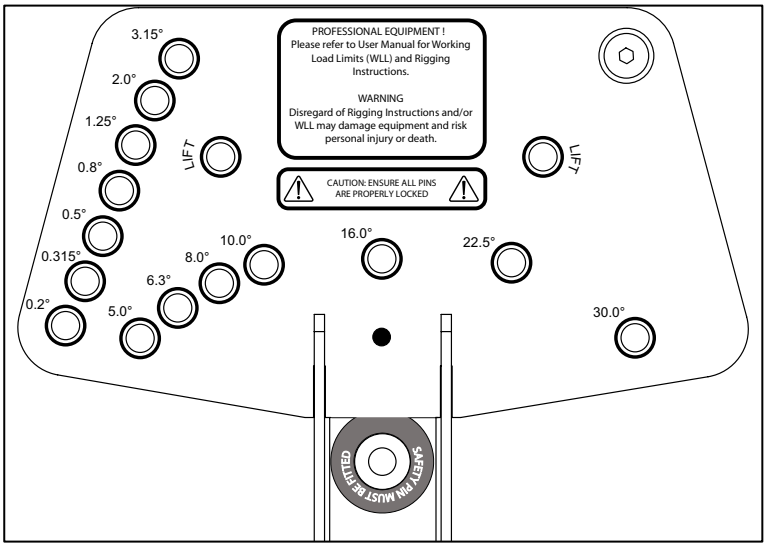
- 1 x Bumper (GEOS12-BUMPER);
- N Pair of Rigging Plates (GEOS12-XBOW-V2) for N cabinets;
- 4xN Quick release pins for N cabinets;
- 1 hoist (not provided).

IMPORTANT

Maximum GEO S12 quantity for flown vertical cluster is 12 (and eventually less).
Please check Geosoft2 for mechanical Safety Working Load computations.

IMPORTANT

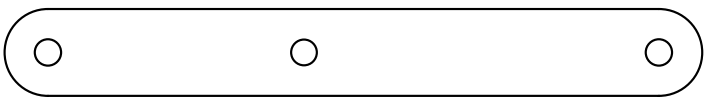
Motor hoist must be rated to support entire cluster weight. Please check configuration in Geosoft2 for proper motor hoist rating



GEO S12 XBOW ANGLE SETTINGS PLATE

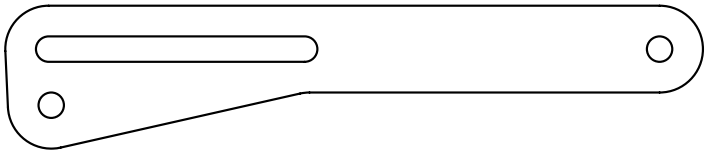
Optional GEOS12-TLB link bar for GEO S12 XBOW

GEOS12-XBOW-V2s are delivered with standard link bars which allow both stacked and flown setups. However, these link bars require perfect alignment of angle setting holes when adding cabinets.



GEO S12 X-BOW STANDARD LINK BAR

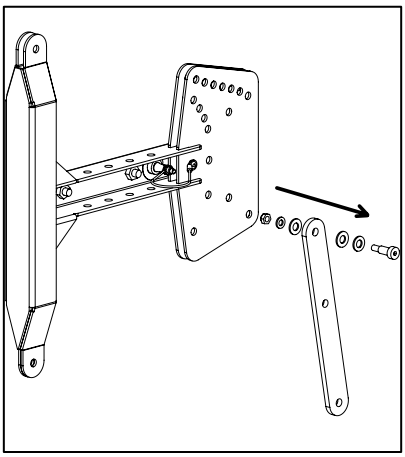
To facilitate flying operation, an optional link bar with oblong holes (GEOS12-TLB, pair of link bars provided with two 8x20 quick release pin) is available in the GEO S12 accessory range.



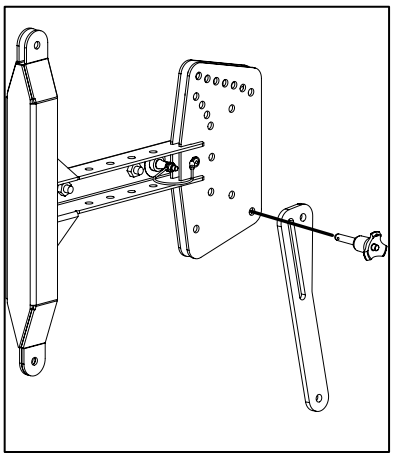
GEO S12 X-BOW OPTIONAL GEOS12-TLB LINK BAR

To install GEOS12-TLB, remove the standard link as well as nut, screw and washers.

When using GEO S12 XBOW for flown setups, insert pins in the oblong hole and opposite circular hole.



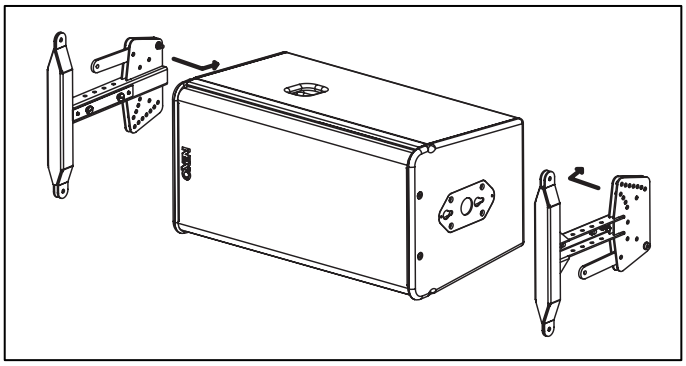
REMOVING STANDARD LINK BAR

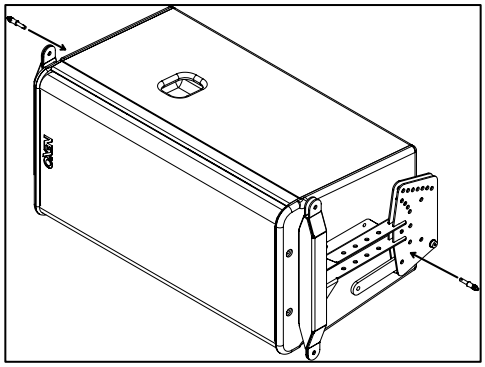


INSERTING PIN - FLOWN SETUPS

Procedure

- Insert GEOS12-XBOW-V2 into connecting plates of both sides of the cabinet;
- Lock safety pins into GEO S12s connecting plate





IMPORTANT

Ensure that safety pins are properly locked into GEO S12s connecting panels.

IMPORTANT

GEO S12 can be flown "Left" or "Right" :

- "Left" means Nexo logo on front grid is left as seen from front;

- "Right" means Nexo logo on front grid is right as seen from front.

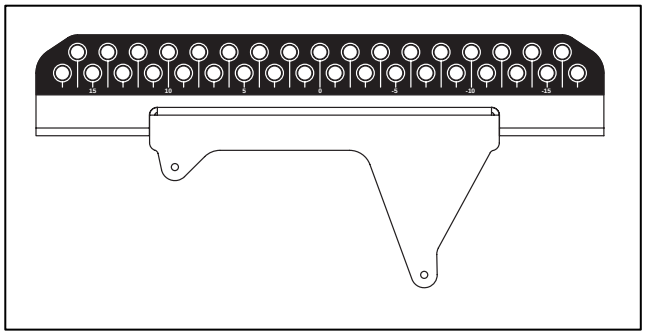
GEO S12 can be connected to bumper "Left" or "Right" by simply flipping the cabinets.

Whenever possible, NEXO recommends symmetrical designs (preferably NEXO logo outwards in stereo configurations)

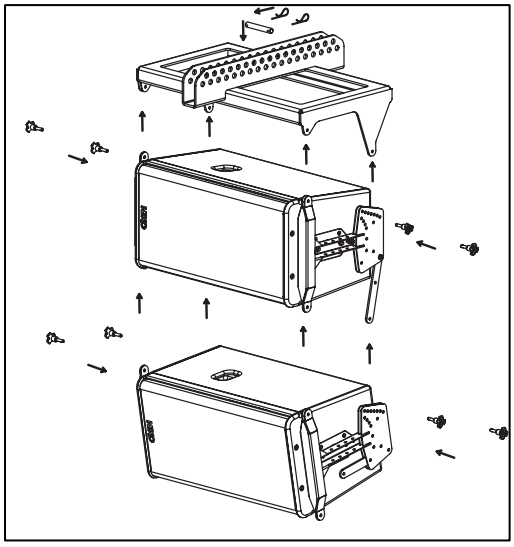
- Connect bumper to first GEO S12 using "lift" points of GEO S12 X-Bows; ensure quick release pins are properly locked;
- Insert axis in bumper Geosoft2 predefined hole and secure it with provided "R" clip;

NB: Bumper holes are numbered #-17 to #17, please refer to Geosoft2 to determine axis position in relation to bumper angle requirements.

If bumper is flown with 2 hoists, then they should be connected to holes #-17 and #17.



- Connect hoist hook to bumper axis and lift assembly to sufficient height in order to connect a second GEO S12;
- Connect second Geo S12 with X-Bow front articulation holes and rear link bars and ensure quick release pins are properly locked;
- Repeat above steps for subsequent GEO S12's



IMPORTANT

Ensure angle settings are identical on both sides of the cabinets.

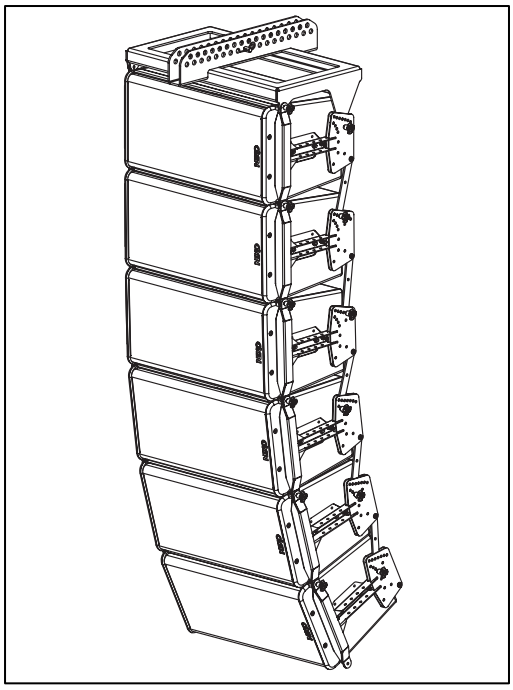
Ensure that safety pins are properly locked into GEO S12s connecting panels.

Ensure that all quick release pins are properly locked into their position.

- Lift cluster to Geosoft2 defined rigging height, secure cluster horizontally to prevent it from rotating;
- Secure bumper with secondary safety steel.

IMPORTANT

The requirements for secondary safety systems vary with territories. However, the secondary safety steel MUST have a SWL equivalent or greater than that of the rigging system.



8.4.9 Ground stacked GEO S1210

Required items

- N Pair of Rigging Plates (GEOS12-XBOW-V2) for N cabinets;
- 1 ground stack device (GEOS12-GSTK);
- 4xN Quick release pins for N cabinets;

IMPORTANT

- Ground stack device GEOS12-GSTK is rated for a maximum of 6 GEO S1210s in any inter cabinet angle configuration, provided this device is assembled according to below rules.

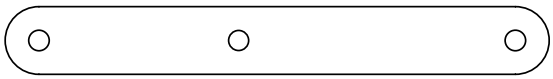
- Ground stack device GEOS12-GSTK must always be installed on a horizontal surface;

- Bottom GEO S12 tilt angle must be limited to +/-10°

- Ensure that public is not allowed within a safety area which radius is equal or higher than assembly height.

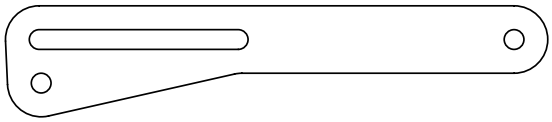
Optional GEOS12-TLB link bar for GEO S12 XBOW

GEOS12-XBOW-V2s are delivered with standard link bars which allow both stacked and flown setups. However, these link bars require perfect alignment of angle setting holes when adding cabinets.



GEO S12 X-BOW STANDARD LINK BAR

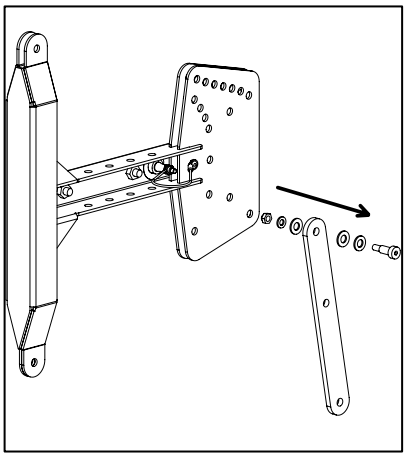
To facilitate flying and stacked operation, an optional link bar with oblong holes (GEOS12-TLB, pair of link bars provided with two 8x20 quick release pin) is available in the GEO S12 accessory range.



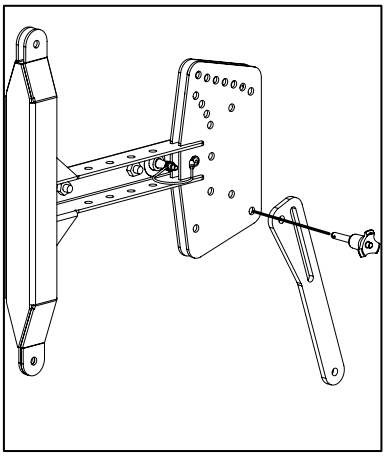
GEO S12 X-BOW OPTIONAL GEOS12-TLB LINK BAR

To install GEOS12-TLB, remove the standard link as well as nut, screw and washers.

When using GEO S12 XBOW for stacked setups, insert pins in the two circular holes.



REMOVING STANDARD LINK BAR



INSERTING PINS - STACKED SETUPS

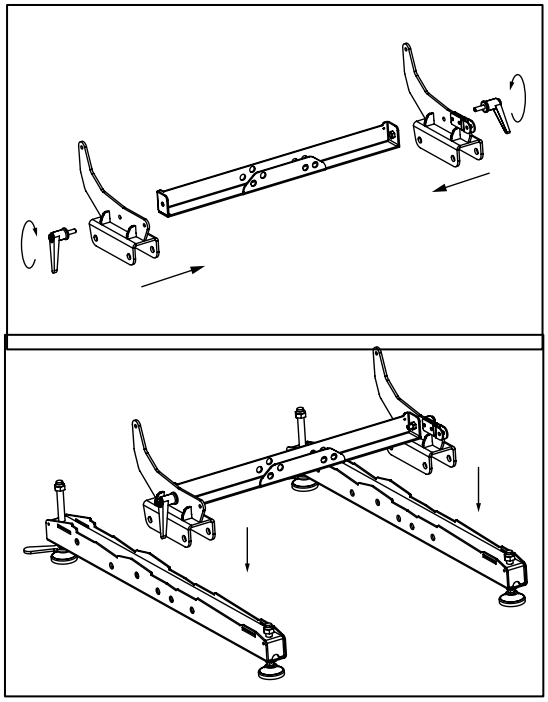
GEO S12 ground stack device description

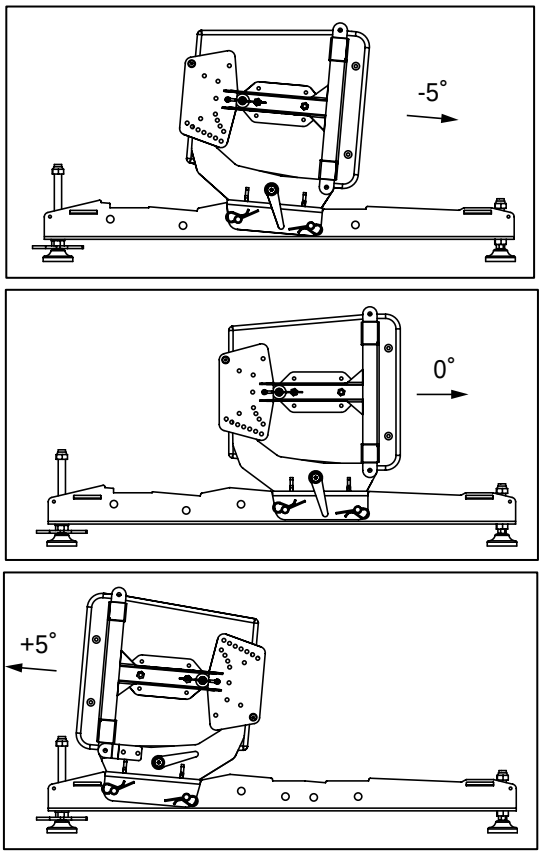
GEOS12-GSTK ground stack device includes:

- two supporting beams, which support assembly weight;
- two connecting beam, which allow connection of the beams to the first cabinet;
- one reinforcement beam, to rigidify ground stack device sideways;
- Axis, “R” clips and handles to assemble the ground stack device

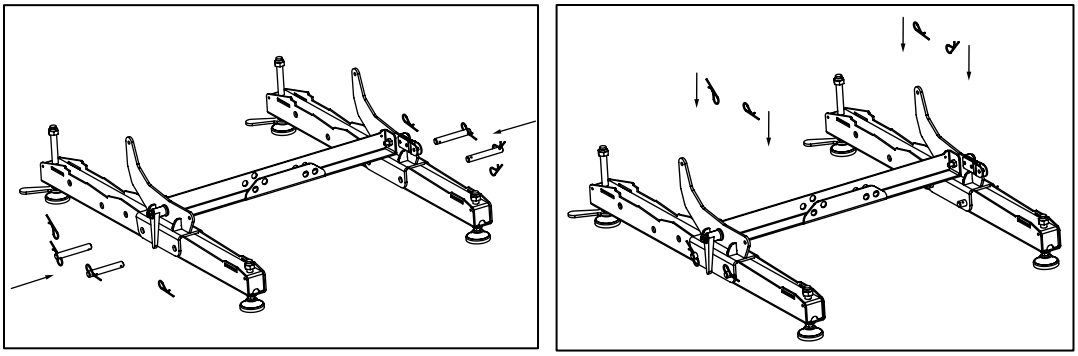
Procedure

- Assemble the two connecting beam and the reinforcement beam with the handles;
- Depending on tilt angle – negative, null or positive - to be achieved, there are three positions to connect above assembly to the supporting beams; below drawings detail these configurations:





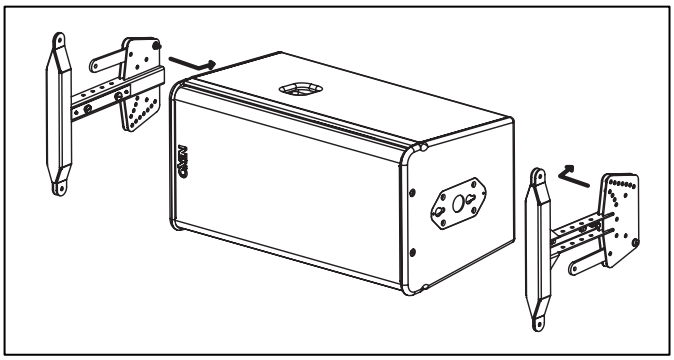
- Connect the reinforcement bar to the supporting beams according to required tilt angle configuration using 2 axis per side; secure the axis with provided “R” clips;

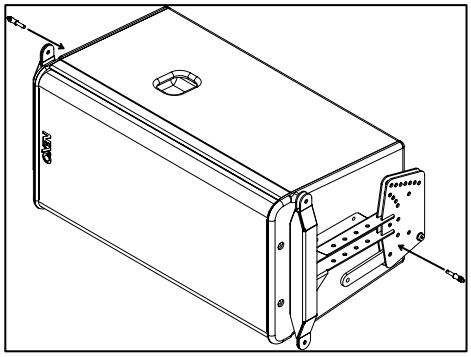


- Insert GEOS12-XBOW-V2 into connecting plates of both sides GEO S12s;
- Lock safety pins into GEO S12s connecting plate;

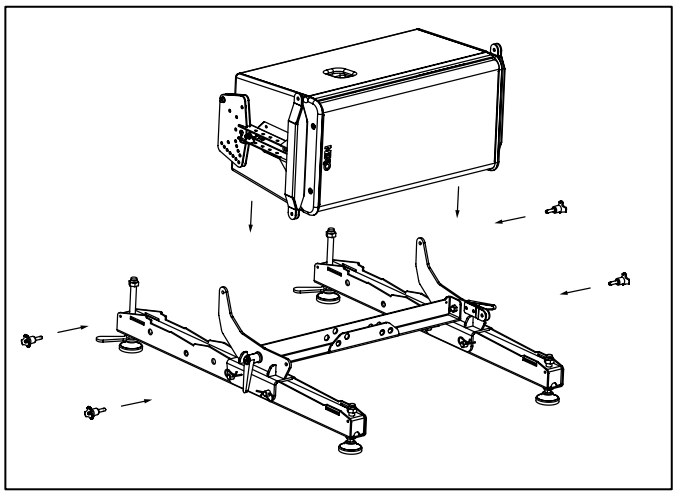
IMPORTANT

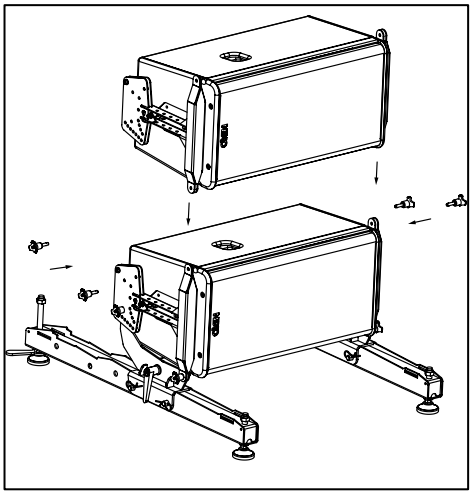
Ensure that safety pins are properly locked into GEO S12s connecting panels.



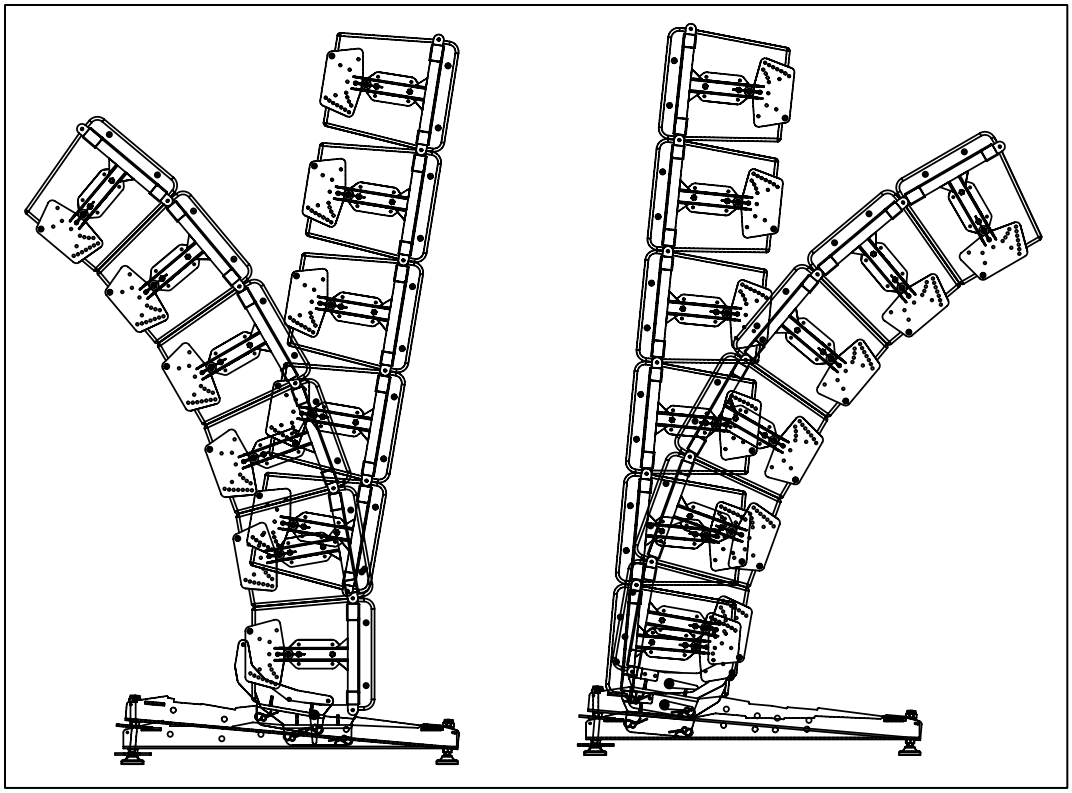


- Connect bottom GEO S12 to GEO S12 Ground stacking device with 4 8x20 quick release pins;
- Connect second Geo S12 with X-Bow front articulation holes and rear link bars and ensure quick release pins are properly locked;
- Repeat above steps for subsequent GEO S12's





- Once the assembly is completed, rotate rear or front GEO S12 ground stack device adjustable legs to definitive tilt angle, ensuring that +/-10° is never exceeded on bottom GEO S12.



8.5 Testing and Maintenance of the system

- General: Geo is a precision piece of equipment and requires regular attention to maintenance in order to give long and reliable service. NEXO recommends regular testing of loudspeaker rigging components, preferably using a suitable test rig coupled with a visual inspection.
- Fasteners: there are several critical points in the GEO S12 cabinets.
- Of primary concern are:
- a) The grid screws attaching the grid to the cabinet
- b) The machine screws attaching the connecting plates to the cabinet.
- c) The screws attaching the directivity flanges to the front of the cabinet.
- These fasteners should be regularly checked and tightened as necessary.
- Cleaning: The exterior of the cabinet and the rigging system can be cleaned with a damp cloth soaked in mild soapy water. On no account use solvent based cleaners , which may damage the finish of the cabinet
- After cleaning, the rigging system must be treated with a suitable lubricant to prevent rusting. NEXO recommends the use of Scottoil FS365 which is a water-based lubricant with a mixture of machine oil, surfactant and anti-rust treatment.

9 NEXO ANALOGUE GEO S12TD CONTROLLER

9.1 Analogue TDcontroller Declaration of conformity

This equipment has been tested and found to comply with the safety objectives and essential requirements of European (73/23/EEC and 89/336/EEC directives) and international Standards, by fulfilling the requirements of the following harmonized standards:

Electrical Safety (EU) : IEC 60065 (12/2001) Audio, video and similar electronic apparatus

Electrical Safety (US) : UL60065 Seventh Edition, dated June 30, 2003 category AZSQ, E241312.

Electrical Safety (CAN) : CSA-C22.2 N°60065:03 Edition, dated April 2003 category AZSQ7, E241312

Electrical Safety (Rest of the World) : CB test certificate DK-8371 based on IEC60065-2001 7nd ed. with all national deviations.

Radiated Emission (EU) : EN55103-1 (1996) Electromagnetic compatibility - Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use.

Radiated Emission (US) : FFC part15 class B

Radiated Emission (CAN) : This Class B digital apparatus complies with Canadian ICES-003.

RF Immunity (EU) : EN55103-2 (1996) Electromagnetic compatibility - Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use.

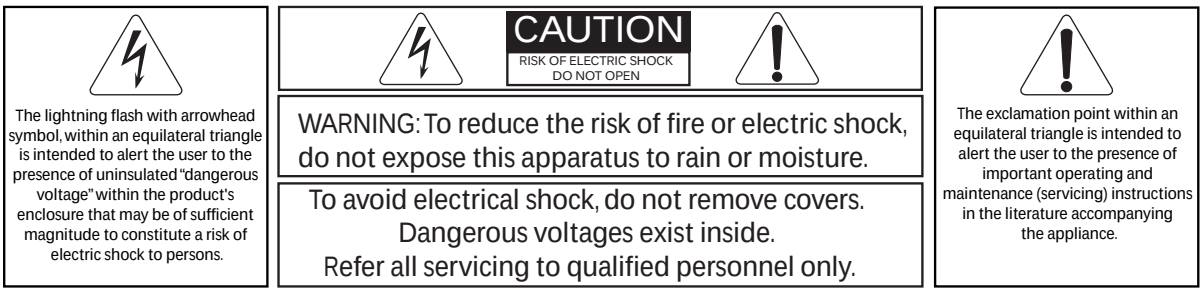
Note: EMC conformance testing is based on the use of recommended cable types. The use of other cable types may degrade EMC performances.

LISTED
Audio Equip
10CE

9.2 IMPORTANT SAFETY INSTRUCTIONS

1) Read these instructions.
2) Keep these instructions.
3) Heed all warnings.
4) Follow all instructions.
5) Do not use this apparatus near water.
6) Clean only with dry cloth.
7) Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8) Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9) Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet. (US market)
10) Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11) Only use attachments/accessories specified by the manufacturer.
13) Unplug this apparatus during lightning storms or when unused for long periods of time.
14) Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

Information about products that generate electrical noise :
NOTE: The United States Federal Communications Commission (in 47 CFR 15.105) has specified that the following notice be brought to the attention of users of this product:
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
The user may find the following booklet, prepared by the Federal Communications Commission, helpful: How to identify and Resolve Radio/TV Interference Problems. This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00345-4. Use of a shielded cable is required to comply within Class B limits of Part 15 of FCC Rules. Pursuant to Part 15.21 of the FCC Rules, any changes or modifications to this equipment not expressly approved by NEXO S.A. may cause, harmful interference and void the FCC authorization to operate this equipment.


The lightning flash with arrowhead symbol, within an equilateral triangle is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.
CAUTION
RISK OF ELECTRIC SHOCK DO NOT OPEN
WARNING: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.
To avoid electrical shock, do not remove covers. Dangerous voltages exist inside. Refer all servicing to qualified personnel only.
The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

WARNING ! THIS APPLIANCE CLASS 1 APPARATUS AND MUST BE EATHED.

The green and yellow wire of the mains cord must always be connected to an installation safety earth or ground. The earth is essential for personal safety as well as the correct operation of the system, and is internally connected to all exposed metal surfaces. Additional recommendation for interconnection to other equipment can be found in the "Analogue TDcontroller Setting-Up Advice" section.

9.3 Analogue TDcontroller Setting-Up Advice

9.3.1 Mains Power

NEXO TDcontrollers don't provide a mean to switch off the unit from the front panel. As they are intended to be rack mounted the back panel is not accessible during use. Therefore it is left to the user to provide a disconnection mean readily operable.

9.3.2 Voltage setting

NEXO TDcontrollers use a switch mode power supply (SMS12). This SMS12 accepts universal AC power input voltages in the range 90V to 264V, and requires no manual adjustment for voltages in this range.

9.3.3 Mounting the TDcontroller in a rack (Grounding, shielding & safety issues)

The TDcontroller is intended for rack mounting. The only accessible part during use shall be the front panel of the TDcontroller. Any space above or under the TDcontroller shall be obstructed with a blank panel.

The rack is a free grounding and shielding structure and it provides extra shielding. Therefore, it is desirable that the screws used to fix the TDcontroller in the frame or rack provide an electrical contact between the chassis of the TDcontroller and the rack.

The primary reason for grounding is safety. Conformance to the applicable requirements of the authorities having jurisdiction is, of course, mandatory. However, grounding also has an impact on electromagnetic compatibility. From the EMC point of view, it is desirable to have a low impedance ground network, as a current flowing in the ground network will then produce low voltage in the network. A low impedance network can be obtained using a multipoint ground scheme, with as many closed ground looS12 as is economically possible.

9.3.4 Fuse

The fuse provided in the unit will not blow during normal operation. If the fuse blows the TDcontroller has malfunctioned. This fuse must only be changed by NEXO certified service personnel. In any case do not replace the fuse with a non-certified NEXO fuse, as this will invalidate the NEXO warranty.

CAUTION!

This servicing instruction is for use by qualified service personnel only. To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

9.3.5 Recommendations for wiring the sense lines

The impedance of the sense inputs of the TDcontroller are high, so currents are low and therefore light duty cable can be used. If the TDcontroller is housed in the amplifier racks an unshielded cable may be used.

If the TDcontroller is located remotely - at the mixing position - a shielded cable is recommended, without using the shield as a conductor. The cable must be well protected from public access, as it carries potentially dangerous amplifier voltage.

When one of the channels is not being used and the corresponding sense line is disconnected, cross talk onto the inactive sense line may in some cases produce signals capable of causing the inadvertent illumination of the Sense LED on that channel; although this has no effect on the internal operation of the TDcontroller, it can be cured by short-circuiting the terminals of the inactive sense line.

9.3.6 Recommendations for wiring the audio outputs

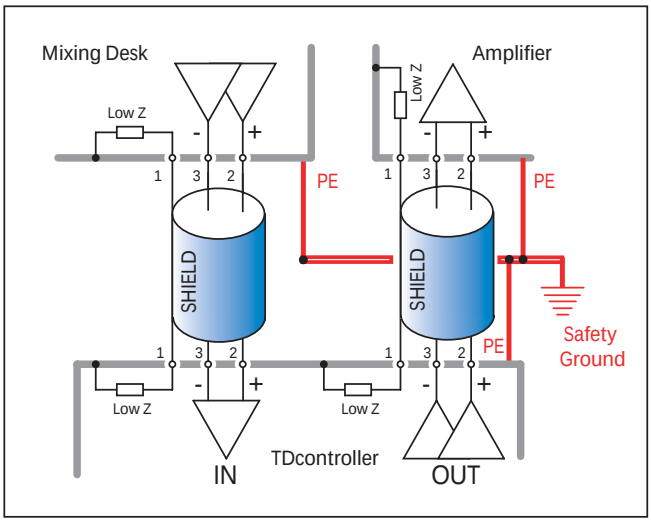
The output stages can drive several amplifiers in parallel; however it is not advisable to work with loads of less than 1kOhm(and strictly forbidden to drive less than 600Ohms). It is best to check the impedance characteristics of the amplifier inputs - supplied by the manufacturer - to check how many amplifier channels can be paralleled. Where precise information is not available (and taking 10kOhm as the minimum value possible), ten channels in parallel per output is a sensible maximum.

9.3.7 Electromagnetic environments

The emission (this word describes all types of electromagnetic noise radiated by the equipment) requirements which have been applied to Nexo's TDcontrollers are the stringent requirements of the "Commercial and light industrial environment" of the product family EMC standard for emission.

The immunity (this word describes the ability to cope with electromagnetic disturbance generated by other items and natural phenomena) requirements that we have considered exceed those applicable to the "Commercial and light industrial environment" of the product family EMC standard for immunity. In order to provide a further safety margin, we recommend that you do not operate the TDcontrollers in the presence of electromagnetic interference exceeding half of the limits found in this standard.

These two EMC standards are those applicable to pro-audio equipment for the implementation of the "EMC directive".



9.3.8 Analogue signal cables

Analogue signals should be connected to the input and output ports of the TDcontroller via shielded twisted pair or starquad cable fitted with XLR connectors on the TDcontroller side. We recommend the use of low transfer impedance cables with a braided shield and a transfer impedance below 10 mΩ/m. For the sense inputs, the noise requirements are not as stringent, and any kind of twisted pair cable will be adequate.

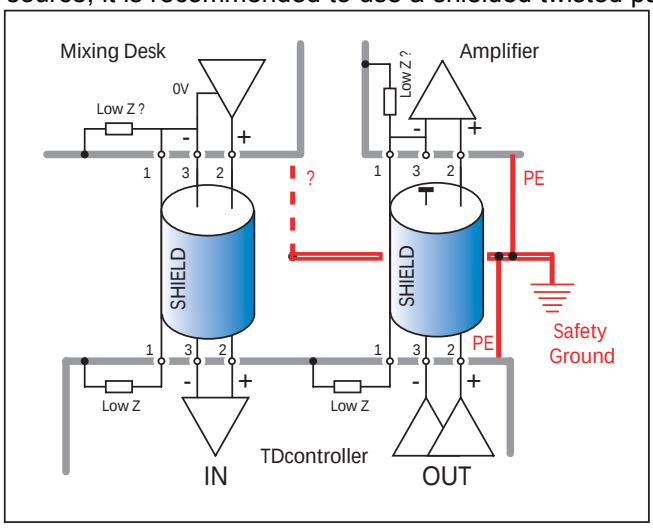
The TDcontroller is intended to be used with symmetrical (balanced) sources (for instance a mixer) and symmetrical loads (for instance a power amplifier (see figure). You can see that the TDcontroller provides a low impedance path between pin 1 of its XLR connectors and its chassis. The TDcontroller can sustain high current in pin 1 without

degradation of output noise. We recommend that the sources and loads you use have the same desirable characteristics.

It is sometimes claimed that connecting cable shield at both ends creates ground looS12, and that the current flowing in such looS12 will produce noise. This is not the case for most professional audio equipment. In short, there are two kinds of looS12 in which voltages are present: the looS12 formed by signal wires, and the looS12 formed by grounded conductors, among which are protective earth conductors (PE) and signal cable shields.

When a cable shield is grounded at both ends, a loop is closed, and the resulting current causes a reduction of the voltage induced on signal lines. This effect is what the cable shield is intended to produce, since this is how it protects your signal from magnetic fields.

If you are using an asymmetrical (unbalanced) source, it is recommended to use a shielded twisted pair and to connect wire 3 of the cable to the shield at the source output end (see figure). This technique prevents noise currents flowing on the return path of the signal. If you are using an amplifier with an asymmetrical (unbalanced) input, it is best to use a shielded twisted pair, and to connect wire 3 at the TDcontroller end only, as shown in Fig. 2. This keeS12 a good capacitance balance for the signal, however noise currents flow on the return path of the signal. (Note that this is only acceptable for a short cable).



If you are using a symmetrical (balanced) source or amplifier which is prone to become noisy when a current of less than 100 mA at the mains frequency (50 Hz or 60 Hz) is sourced into pin 1 of its XLR connectors, you might consider opening the ground looS12.

9.4 Analogue TDcontroller USER GUIDE

9.4.1 Read before use

The Analogue TDcontroller is designed to be used with its proper set of speaker cabinet. They are not interchangeable. Its main functions are:

- To optimize the response of the system
- When operating with the SubBass system (optional), splitting the stereo (2 channel) signal into 2 frequency bands (S12 main system and SubBass system)
- Active protection of the cabinets by dynamic audio signal processing (Temperature and Displacement servo control)
- Reduction of amplifier overload (Peak limiter function)

Analogue TDcontrollers also feature:

- Stereo operation (2 independent channels) for the main system
- Global switchable output level
- Adjustable level on the SubBass channel

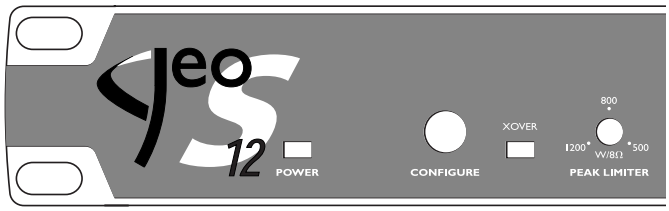
- High CMRR input stage and High current drive output
- Compensation of power compression effects on the system response curve.

The Analogue TDcontroller is designed to be inserted between the Audio source (console, preamplifier, etc.) and the power amplifier.

9.4.2 Front Panel

Most front panel functions and indicators are located inside 2 distinct windows: left-hand areas relate to functions and indicators dedicated to the optional Sub-bass section, while right-hand window contains indicators concerning servo control operation for the S12 cabinets.
For more technical details about servo control operation and internal electronic processing, please refer to section “TDcontroller REFERENCE GUIDE.” Page 74.

Turning the LS channel Overlap / Crossover

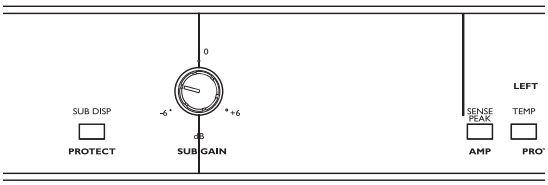


Pushing the CONFIGURE button modifies the high pass filtering. It does not affect the sub output, which will always be a filtered sub signal. (This is therefore not a Sub on/off button). In the « Overlap » position, the S12 is exploited to its maximum capability.

This position should be used if the system is being used without a Subbass. It can also be used with the Subbass; In this case, there will be a boost in the crossover area. The « Cross over » position is generally recommended when using the Subbass.

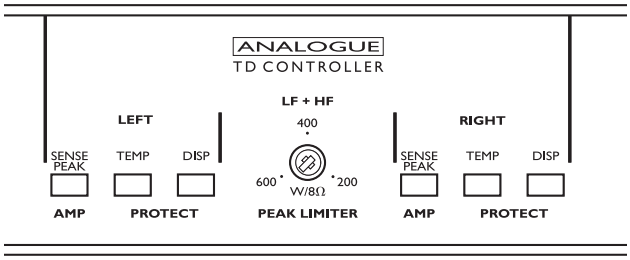
Adjusting the Subbass level (Sub Level)

The potentiometer adjusts the level of the Subbass channel, a range of 12 dB allows a variety of configurations and application conditions to be accommodated. Center position of the knob is calibrated for 1 Subbass used with 2 distant S12.



Amplifier & Protection indicator

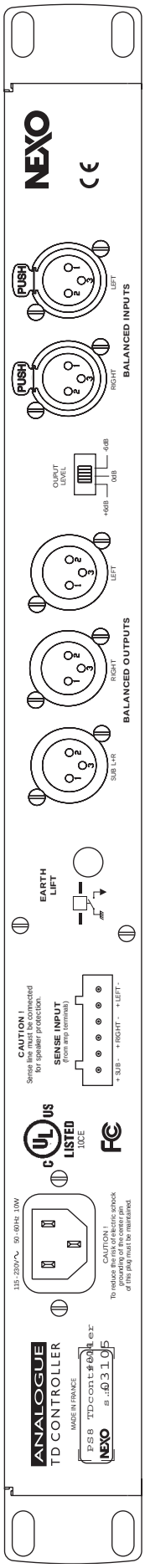
The bicolor green/red AMP LED indicates signal presence at the sense input of the concerned channel, allowing visual confirmation of the return connection of the Sense cables from the amplifier output. The LED is flashing red, when the Peak limiter is acting, reducing excessive peak voltage or levels capable of overloading the channel amplifier.



- The yellow VLF LED indicates that displacement protection for the Subbass are engaged on the SubBass channel. The temperature protection is not monitored.
- On each side of the S12 main system window, yellow TEMP and DISP LEDs indicate when protection has been activated (temperature or displacement control) for the LF (the HF drivers temperature protection is not monitored).

Peak Limiter adjustments

The Analogue TDcontroller features two independent peak limiter trims (one for the LSsub amplifier section, one for the S12 amplifier section), which allows the peak limiter to be set to limit the maximum power of the amp (without affecting the protections threshold). The peak limiter has no real cabinet protection functions; it must be tuned to avoid overdriving the amp that in turn can generate obvious clipping noise.



To set the peak limiter to the correct value, either turn the trimmer clockwise until the red LED lights at the same time as the amp's clipping LED, or use the graduation (power value given for 8Ωload).

9.4.3 Rear Panel

Audio Inputs

The audio inputs are two 3-pin female XLR connectors located in the area labeled BALANCED INPUTS. Signal is applied between pins 2 and 3, pin 1 is connected to ground. When the Controller is linked to a signal source with balanced outputs, the XLR connections are simply wired pin to pin (1 to 1, etc.). As a result of the balanced nature of the outputs (and providing that balancing is respected by way of the connection to the amplifier), there is no hot or cold pin - the Analogue TDcontroller being neutral regarding the polarity of the signal.

Output Level Switch

The 3-position output level switch is used to match the processor gain to the amplifier gain for optimum signal to noise ratio. The three gain values available are +6, 0 or -6 dB. For minimum noise floor the -6dB setting should be chosen, for maximum headroom the +6dB position should be used.

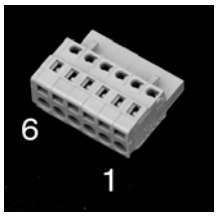
Audio Outputs

The audio outputs are the three 3-pin male XLRs located in the area labeled BALANCED OUTPUTS. The channel corresponding to each output connector is identified by the labels Left, Right and Sub L+R (mono SubBass).

Signal is applied between pins 2 and 3, pin 1 is connected to ground.

When used with an amplifier with balanced inputs, the wiring of the output XLR is simply pin to pin (1 to 1, etc.), the polarity of the signal being preserved if the source connected to the input is also balanced (see previous section).

Sense inputs

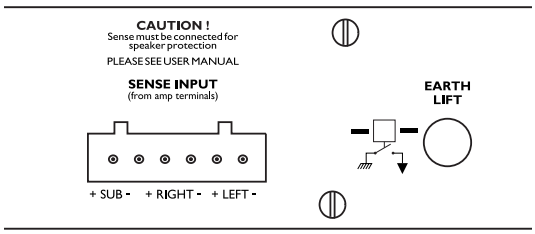


The sense inputs of the three channels (left, right and SUB) are arranged on a six-pole barrier strip set into the rear panel within the area labeled SENSE INPUT. The Sense inputs are intended for connection to the output signals of the amplifiers driving one cabinet of each the channels being used.
Connection is made via the female part - removable - of the connector (supplied with the Controller) as outlined below:

Channel	Amplifier Output Terminal		Barrier strip connector
S12 Left	- (black)	⇨	pin 1 (figure)
	+ (red)	⇨	pin 2
S12 Right	- (black)	⇨	pin 3
	+ (red)	⇨	pin 4
RS15	- (black)	⇨	pin 5
	+ (red)	⇨	pin 6

Input sense connection **MANDATORY** for proper operation of the servo-control system, the cabinets will NOT BE PROTECTED if the sense lines are unconnected.

Earth Lift

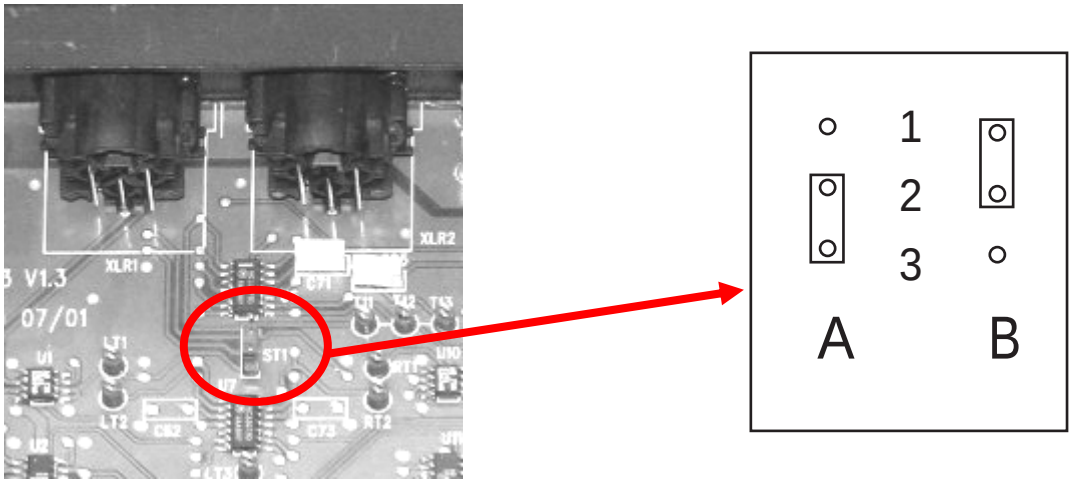


The push button labeled « Earth Lift » allows connection (depressed position), or disconnection (out position) between the signal ground and the mains earth, which is itself linked to the chassis. Using this button may help to eliminate hum due to ground looS12 created in the system.

Sub jumper

In certain applications you may wish to disable the mono summation (but keep the 6dB gain boost) on the sub channel. By moving the internal jumper ST1 inside the unit, the sub channel will only use the Right input (with 6dB gain to keep the same sub level when the mono summation is enabled).

Always ensure that your TDcontroller is disconnected from main before opening the unit. Remove the 3 screws fastening the top panel. The ST1 jumper is located near the Input XLR. The PIN1 being the PIN closest of the Input XLR. Strap PIN 1-2 (B in the drawing) in order to drive the sub only from input R. Strapping Pin 2-3 (labeled A, factory default) will provide the summation of channel R&L.



9.5 TDcontroller REFERENCE GUIDE

9.5.1 Linear section

The characteristics of the linear section are independent of signal level, as opposed to the servo control functions described in next paragraph.

Subsonic and VHF filtering

Low and high-pass filters are used to remove signals out of the usable frequency range, eliminating sub- and ultra-sonic components that could possibly degrade the performance of the Controller and amplifiers. These filters are optimized to realize the overall target system response.

Equalizing acoustical response

This equalization section provides the required correction to obtain a flat system response, as the cabinets are acoustically designed for maximum efficiency in the whole frequency range. Active rather than passive attenuation allows amplifier voltages to be lowering for a given output SPL and therefore increases the maximum SPL achievable with the same amplifier.

Active equalization also extends system bandpass, especially at low frequencies where acoustical performance is limited by cabinet size.

S12 / Subbass Cross-Over

From input signals summed together, the resulting mono signal is low-pass filtered to feed the SubBass channel. When the channel is turned on (Subbass On), main channels (Left & Right) high-pass filters are reconfigured to filter out signal components below the crossover frequency. Slopes and other filter characteristics are optimized using techniques optimized for the actual acoustical data of each driver.

9.5.2 Servo Control section

Servo control of the S12 TDcontroller is intended to work with amplifier return signals present at the Sense inputs (monitored by front panel LEDs).

VCAs and VCEQs

Each of the 3 Audio channels (Left, Right and SubBass) contains two voltage controlled elements driven by servo signals:

- One operates on the whole frequency range (wide band VCA).

- The other elements work selectively as dynamic equalizers (LF-VCEQ & HF-VCEQ).

Depending on the nature and origin of the servo signals, either one or the 3 combined elements is used to process the Audio signal. This feature allows more efficient processing while reducing audible effects.

Displacement control

The signal from the sense input is fed through a shaping filter producing a signal proportional to the voice coil displacement. This control signal is compared to a fixed value and if exceeded, the LF-VCEQ is activated with very short attack time to reduce speaker excursion.

Temperature control

Sense input is fed to a shaping filter to create a voltage proportional to the instantaneous voice-coil current. The signal is integrated over time to simulate heat buildup in the specific driver. When the resulting voltage exceeds a preset threshold, the VCA is activated to limit the voice coil temperature within its safety range. Power compression is also simulated by lowering the high frequencies when temperature protection is acting on the bass loudspeaker.

Dynamic control

To reduce audible « pumping » effects due to very long time constants of temperature detection signals, an alternate integration is also processed with a shorter time constant. Whilst anticipating the temperature protection and reducing its unwanted effects, action of this signal also improves dynamics control.

Peak Limiter

The above mentioned devices provide reliable protection against potential speaker over-heating and over-excursion. Nevertheless driving the cabinets at very high peak voltages (with oversized amplifiers) as well as delivering distorted signals might be dangerous for the speakers. The Peak limiter is both useful for:

- Maintaining good sound quality at high levels (it will reduce amplifier distortion).
- Increasing protection reliability (limiting peak voltages to levels that speakers can permanently withstand, and reducing the occurrence of subsonic signals delivered by overloaded amS12)

10 NEXO NX242-ES4 DIGITAL CONTROLLER FOR GEO S12

IMPORTANT

GEO S12 use latest NEXO proprietary sophisticated DSP algorithm, which require additional resources from the NX-Tension ES4 Card. All available GEO S12 setups require that NX-ES4 card is installed in NX242 TD Controller.

10.1 NX242 Proprietary Functions

The NX242 is much more than a "generic" Digital Signal Processor. It provides all the standard functions that you expect from this type of unit, but its real value is the interface between you and your speaker system. The NX242 includes a number of proprietary functions, developed and refined during NEXO's 20 years of loudspeaker development experience, to ensure that your PA delivers maximum performance and reliability.

10.1.1 Upgradable Firmware

NEXO releases regular firmware updates. Each new release is the result of our ongoing R&D program combined with user feedback from the field. New firmware releases can include new setups for different combinations of NEXO full range loudspeakers and subwoofers, improvements to existing setups, and new software functions. The NX242 is thus evolving with each of those releases, profiting from the latest discoveries of NEXO's R&D department as well as the experience of NEXO users.

10.1.2 EQ & Filtering

Subsonic and VHF filtering

Low and high-pass filters are used to filter out frequencies that could possibly degrade the performance of the TDcontroller and amplifiers. The filters are optimised to work in conjunction with overall system response.

The high pass filters are also extremely important as they help control excursion at very low frequencies, which is a major feature for system reliability. This is one of the main reasons to avoid using setups which are not designed for the cabinet you are using.

Equalising acoustical response

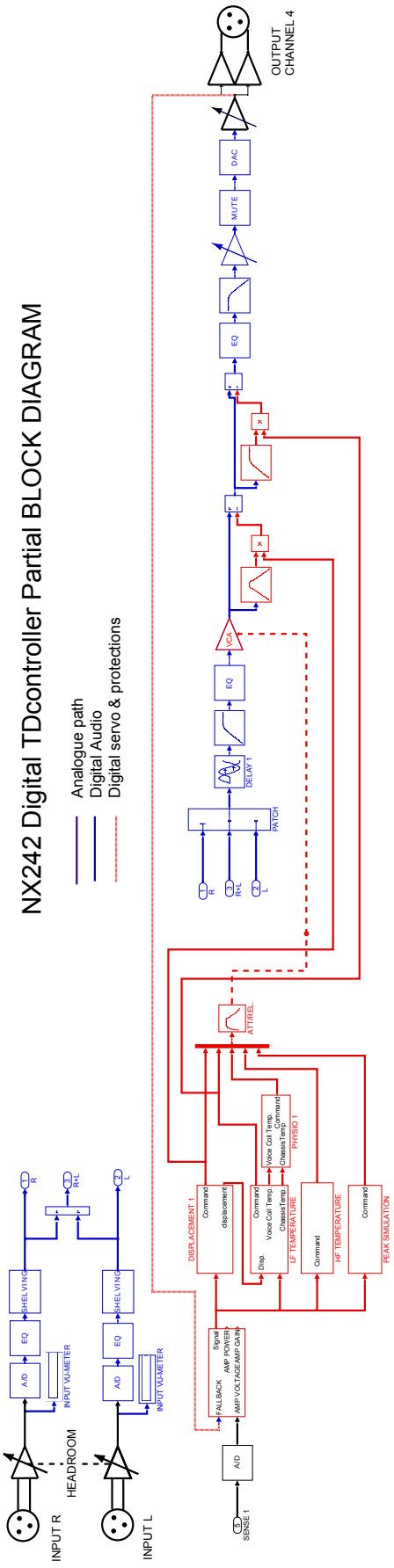
NEXO loudspeakers are acoustically designed for maximum efficiency over their operating bandwidth. The NX242 provides the correction required to obtain a flat system response. Active rather than passive attenuation allows the lowering of amplifier voltages for a given output SPL and therefore increases the maximum SPL achievable with the same amplifier. Active equalisation can also extend a NEXO loudspeaker's frequency response, especially at low frequencies where acoustical performance is limited by cabinet size.

While many DSP processors can provide this type of EQ, none can include the extensive measurement facilities and listening tests employed by NEXO R&D when adjusting NX242 setups for a particular loudspeaker.

Crossover section

Crossover between different bands is tuned for every set-up of every cabinet. The crossover is designed to ensure the best phase alignment possible throughout the crossover overlap region.

Each crossover is "made to measure" in order that each transducer can fit with its neighbour by achieving a perfect phase alignment. Unconventional filters are used, ranging from 6dB/octave to near infinite slopes depending of the type of crossover wanted. Time alignment is also performed in an unconventional way, by using the crossover filter group delays in combination with allpass and/or frequency dependent delays.



10.1.3 Protection

VCAs and VCEQs

Each channel has its own simulation and protection process.

Each audio channel contains a combination of controlled gain stages (let's call them VCAs as in analogue circuitry). These VCAs are embedded into complex composite signal chains that adapt change their basic operation into frequency selective attenuation, similar to an analog voltage controlled dynamic equaliser (VCEQ).

Each VCEQ and VCA is controlled via synthesis of several signals from the various detection sections. That synthesis is in fact the envelope of those signals, with an optimised release and attack time for each VCEQ and VCA (depending on its frequency range and the cabinet selected).

Displacement Control

The Sense input signal is sent to a shaping filter producing a signal whose instantaneous amplitude is proportional to the voice coil excursion. This signal, after rectification, is compared to a preset threshold matching the maximum usable value, as determined from laboratory measurements. Any part of the signal exceeding the threshold is sent to the VCEQ control buffer while the VCEQ acts as an instantaneous (very short attack time) limiter to prevent displacement from exceeding the maximum permissible value.

Temperature Control

Each sense signal is fed into a shaping filter (one per transducer), each one producing a signal proportional to the instantaneous current flowing into the voice coil of the transducer. After rectification, this signal is integrated with attack and release time constants equivalent to the thermal time constants of the voice coil and chassis, producing a voltage, which is representative of the instantaneous temperature of the voice coil.

When this voltage reaches the threshold value corresponding to the driver's maximum safe operating temperature, the VCA becomes active to reduce the NX242's output signal level until the effective temperature falls below the maximum usable value.

In order to avoid detrimental effects induced by very long release time constants produced by the temperature detection signal (system output being reduced for an extended period, "pumping" effects, etc.), the detection signal is modulated by another voltage integrated with faster time constants that match the subjective perception of sound level. This allows the controller to reduce the effective operating duration of the temperature limiter and make it sound more natural, while the efficiency of protection is fully preserved and protection thresholds are kept as high as possible.

Physiologic Dynamic Control

The Physiologic Dynamic Control is intended to avoid unwanted effects produced by long attack time constants. By anticipating the operation of the temperature limiter, it prevents a high level audio signal appearing suddenly, then being kept up for long enough to trigger the temperature limiter. Without this, a rough and delayed gain variation would result that would be quite noticeable and unnatural.

The Physio control voltage acts independently on the VCA with its operation threshold slightly (3 dB) above that of the temperature limiter and a low compression ratio; its optimised attack time constant allows it to start operating without any subjectively unpleasant transient effects.

Peak Limiter

The peak limiter primary function is to avoid massive clipping of the amplifier, which can have some very audible artefacts and in some cases may be damaging to the loudspeakers. Modulation of the amplifier's supply voltage rails can create very low frequencies or high-frequency, high level harmonics. Since these occur after the NX242 in the signal path, they are not filtered by the TDcontroller circuitry.

The threshold of the peak limiter is set by the user to match the amplifier's clipping point.

The second function of the peak limiter is to avoid huge amounts of power being sent to a driver. Each driver is protected against overheating and overexcursion, but there could be other failure modes that cannot be predicted by simulation (especially mechanical damage to the cone). Each driver is specified for a certain power handling and a factory set peak limiter threshold is tuned to avoid any abuse.

10.2 Trouble shooting

The NX242 has been designed to be user-friendly. However with highly technical systems such as GEO S12, incorrect adjustment of the NX242 can lower the quality & safety of your system. Listed below are the most common errors encountered by NEXO Technical Support.

10.2.1 Operation of Multiple TDcontrollers output channels

Typically, GEO S12 systems require multiple NX242's output channels per side. Eventually, two or more NX242's channels will operate within the same cluster. It is mandatory to verify the consistency of the setups and adjustment between these channels to avoid the problems described below.

IMPORTANT

When using multiple NX242's output channels in a single array, all parameters should be consistent and set to proper values on each channel.

10.2.2 Amplifier Power (MENU 2.7)

If the amplifier power (MENU 2.7) is set to a value below the amplifer's actual power, the peak limiter of the NX242 will trigger continually, creating audible distortion. Please note that this peak limiter is not set to act as a compressor on the signal. It is intended to minimize the clipping of the amplifier by operating slightly after the amplifier's clipping point.

One way to properly adjust this parameter is to set amplifier power at maximum (5000W) and decrease the value until the amplifier and TDcontroller clip at the same time.

10.2.3 Amplifier Gain (MENU 2.6)

It is very important to check the gain of each channel. These values should be set in agreement with amplifier gain. The second line of the MENU2.6 displays the gain as seen by the NX242 to ease the setting of this parameter.

10.2.4 Gains

If your amplifier gains are not the same on each channel, you will have to adjust the inter-channel gain in order to compensate for this amplifier gain difference.

10.2.5 Delays

Multiple NX242's can be used on a single GEO S12 array. When changing the delay in one NX242 TDcontroller that is part of a multi-controller system, take great care to have exactly the same delay setting in all NX242 TDcontrollers that receive the same input signal (i.e. all NX242's that are fed from the Left output of the mixing console should have the same delay settings). A Tangent Array is very sensitive to delay differences between sections of the array in the same line. You could experience coverage problems if all delays applied to a Tangent Array are not equal.

Please refer to the chapter in the NX242 User Manual on setting delay for proper time alignment between GEO S12 and ALPHA S2 / CD18 / GEO SUB .

10.2.6 Reversed Cardioid Pattern

Polarity checks are often performed while the system is being set up. Keep in mind that cardioid speakers may also require a coverage test. If you invert two outputs of the NX242, you could have the main lobe inverted and firing to the rear. It may be quite hard to detect a reversed cardioid pattern when it involves one section of a large array.

A good practice is to test the each cabinet in the array with the front speakers only. The system is then omni-directional. Then turn on the back speaker: you should notice a massive reduction at the back, and additional level at the front.

This test must be done in addition to the usual polarity test.

10.2.7 Using the wrong NX242 setups for a given cabinet

Each NX242 setup is tailored for a certain NEXO loudspeaker. Using the wrong setup will create safety and quality problems. Always check that every cabinet in your system is being driven by the correct NX242 setup.

10.2.8 Connections

To ensure correct electronic behaviour, and to guarantee specifications and EMC performance, a NX242 must be properly wired. Always use balanced connectors with the shield connected to pin 1 on both sides. For more wiring recommendations please refer to the application note in the NX242 manual update.

11 SYSTEM ALIGNMENT GUIDELINES

The NX242's factory delay presets are optimised to provide the best possible crossover between the GEO S12 and CD18 / S2 / GEO SUB systems. The reference point for this adjustment is the front of each cabinet**.** (This means that the internal delays needed to achieve a correct time alignment are set for cabinets standing next to each other with both fronts aligned). We recommend that the system is adjusted so that arrivals from GEO S12 and CD18 / S2 / GEO SUB are coincident at a fairly distant listening position.

11.1 GEO S12 Vertical Cluster design

Cluster design must be done with Geosoft2, which provides very intuitive and fast method to determine all cluster geometry parameters in relation to venue where cluster is implemented.

IMPORTANT

Geosoft2 is a freeware downloadable on www.nexo-sa.com. Please check our website periodically for upgrades.

Never install a GEO S12 cluster without checking its acoustical performances and mechanical safety in Geosoft2 prior to installation.

Please contact your local distributor for assistance and/or training on Geosoft2

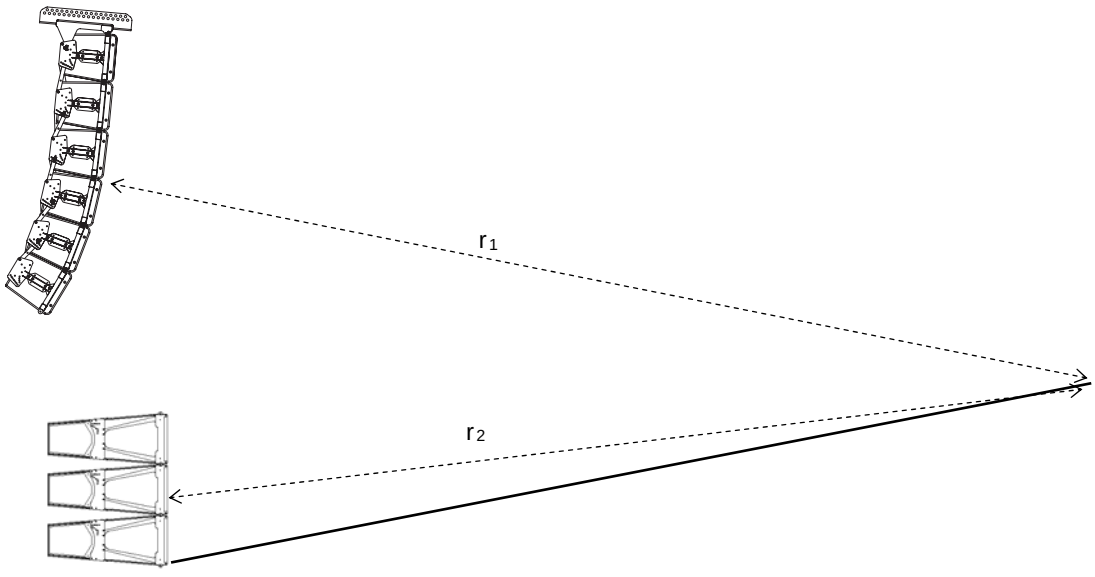
11.2 Stacked RS15 / CD18 / S2 / GEO SUB and Flown GEO S12

Recommended NX242 GEOS12 setup family: X-OVER

In the example below, r_1 being the distance from GEO S12 array to listener position, and r_2 being the distance from GEO SUB to listener position, the distance difference is then $r_1 – r_2$ (specified meters or feet).

- $r_1 > r_2$, the delay should be set on the CD18 / S2 / GEO SUB NX242 TDcontroller channel.
- $r_1 < r_2$, the delay should be set on the GEO S12 NX242 TDcontroller channel
- To convert the result in time delay (specified in seconds), apply:
- $\Delta t = (r_1 - r_2)/C$ r_1 and r_2 in meters, C (sound speed) ≈ 343 m/S.

The delay parameter is set in MENU 1.2 (set the units to meters, feet or seconds according to your preference). Delay will have to be adjusted according to the distance difference $r_1 – r_2$ (see figure below).



11.3 Driving the GEO SUB's from the AUX send

It is quite common to use the AUX send of a mixing desk to drive the Sub section of a PA system. This gives the mixing engineer more flexibility to set the level of the subbass relative to the main PA, apply special effects, or to use a different EQ on the Sub. However, it also raises some serious issues for the performance & safety of the system (mostly time alignment).

At NEXO, great care is taken to design optimum phase alignment from one octave above to one octave below the crossover frequency point. By doing so, drivers are working perfectly together and providing the best efficiency possible. It is then up to the user to adjust the delay on the NX242 to match the physical path difference of the different systems. It is thus possible to get a well adjusted system, even without measuring instruments.

If CD18's / GEO SUB's / S2's are driven form an AUX output, NX242 is fed with two signals coming from different sources. If those two sources (MAIN output & AUX send) are not exactly in phase, delay is introduced into the crossover between the GEO S12 array and the CD18's / GEO SUB's / S2's. It is then mandatory to use proper measurement tool to optimize phase response.

Why is it unlikely that AUX and MAIN outputs have the same phase?

- Signal paths are likely to be different; any filter modifying the bandwidth and EQ of the signal is also affecting the phase.

  Example: a 24dB/oct high pass filter set at 15Hz is affecting amplitude of the signal by only 0.6dB at 30Hz, but the phase shift is 90°!! At 100Hz we can still measure 25° of phase shift.

- Limiting bandwidth with a low pass filter can introduce a phase difference of up to 180° (completely out of phase) at the cross over point.

- If the signal is passing though any digital equipment, between 1.4ms and 2.2ms is being added (around 70° phase shift at 100Hz) due solely to the converter delay! The additional delay due to the processing itself (look ahead compressor, delay…) can be quite important as well.

If both outputs are not measured in the actual configuration, it is very likely that phase alignment will not be correct.

Consequences of badly aligned systems

Mis-aligned systems have lower efficiency: i. e. for the same SPL the system will have to be driven harder, activating the displacement & temperature protection at lower output levels. Both sound quality and reliability will decrease as the system is stressed.

Precautions & Checks

Before using the AUX of a mixing desk, ensure that MAIN and AUX outputs are in phase;

Always apply identical EQ or processing on both channels, so that the phase relationship will not be altered;

Never add additional low pass filtering on the SUB or high pass filtering on the main system;

Inverting polarity on one channel should always result in a massive difference near the crossover point. If that is not the case, the system is no longer aligned.

11.4 Recommended installation tools and equipment

- Tape measure – should be 30m/100ft in length and be of durable fibre material. Have one per array available to speed up the installation process.

- Laser Inclinometer – For measuring vertical and horizontal angles in the venue. An ideal product is the Calpac 'Laser projecting a dot' version which costs approximately 60 €.

- Digital remote inclinometer – with a remote sensor in the bumper and a meter unit at ground level to ensure precise installation of the cluster. NEXO GeoSight system predicts the stationary angle

of the array, even while it is swinging, and has a green laser mounted coincident to and parallel with the axis of the topmost cabinet.

- Spirit level – used to ascertain the trueness of the surface from which the angle measurements originate.
- Rangefinder measuring device – either a Disto type laser measure or an optical laser rangefinder can be used. Devices such as the Bushnell 'Yardage Pro' sports rangefinders provide sufficiently accuracy and are easy to use. They have the additional advantage of working very well in bright sunlight.
- Electronic calculator with trigonometric functions to calculate the height from ground level to points in the room. The formula to calculate height of a point from measured angle and distance is:
- Height of point = Sin(vertical angle in degrees) x distance to point
- NB: Take care when using spreadsheets as they calculate using radians by default. To convert degrees to radians use the formula:
- Angle (in radians)=3.142 x Angle (in degrees)/180
- Computer – Laptop or Desktop PC running Windows XP with the current version of NEXO GeoSoft2 installed. It is not possible to configure a Geo tangent array properly without using GeoSoft2. Note that, when GeoSoft2 designs are prepared prior to arrival at the venue, it is often necessary to modify or update the design to accommodate special circumstances. A PC is absolutely essential to make such changes.
- Audio Analysis Software – recommended but not absolutely essential, programs such as Easera Systune, Spectralab or Spectrafoo enable rapid and detailed analysis of the installation. Consider taking a training course in using one of these tools if you are not already competent with them – it will pay dividends in increased performance of the system.

12 GEO S12 – RS15 / CD18/S2/GEOSUB SYSTEM CHECK LIST

It is essential to execute all these check steps prior to perform a sound check on the "front end" to the system. Following this checklist step by step will prevent many troubles and will save time in the end.

12.1 Are the NX242 Digital TDcontrollers properly configured?

IMPORTANT

If you must change any of the parameters listed above, make sure that you use the same values on all NX242's.

12.1.1 NX242 settings

Output Assignment

NX Setup / NXChannel	1	2	3	4
GEOS12 Passive 4 Channels	GEO S12 Ch1	GEO S12 Ch2	GEO S12 Ch3	GEO S12 Ch4
RS15 Omni Stereo - GEOS12 Passive Stereo	RS15 Left	RS15 Right	GEO S12 Left	Geo S12 Right
RS15 Cardio Mono - GEOS12 Passive Stereo	RS15 Rear	RS15 Front	GEO S12 Left	Geo S12 Right
S2 Stereo– GEOS12 Passive Stereo	S2 Left	S2 Right	GEO S12 Left	Geo S12 Right
CD18 Mono – GEOS12 Passive Stereo (1)	CD18 Rear	CD18 Front	GEO S12 Left	Geo S12 Right
GEO SUB Mono - GEOS12 Passive Stereo (1)	GEO SUB Rear	GEO SUB Front	GEO S12 Left	Geo S12 Right
GEOS12 Active 2 Channels	GEO S12 LF Left	GEOS12 HF Left	GEO S12 LF Right	GEO S12 HF Right
RS15 Cardio – GEOS12 Active Mono	RS15 Rear	RS15 Front	GEO S12 LF	GEOS12 HF
CD18 – GEOS12 Active Mono	CD18 Rear	CD18 Front	GEO S12 LF	GEOS12 HF
GEO SUB – GEOS12 Active Mono	GEO SUB Rear	GEO SUB Front	GEO S12 LF	GEOS12 HF

Output parameters

Output Label	Amp Gain (2)	Amp Power (2)	Global Gain	Global Delay	Sense Gain	Array EQ (3)	Headrom (4)
All channels	26 dB	refer to amp	0 dB	0 ms	0 dB	0	5 bars

(1) Local gain and delay values are inter-locked channel 1&2

(2) values for recommended amplifier gain and power : should be set in agreement with selected amplifiers specifications

(3) Should be in agreement with implemented cluster; acts on a shelving filter designed to compensate for LF coupling.

(4) Disabled when using digital inputs.

12.2 Are the amplifiers properly configured?

Freq. Band	Mode	Gain Switch	Limiter	High Pass
All channels	Stereo	26 dB	None	None

12.3 Are the amps and the NX properly connected?

Check that the sense lines on the NX242's are properly connected by applying a signal to the corresponding output and verify that the correct Sense LED illuminates.

12.4 Are the speakers properly connected and angled ?

- Attach the first series of modules to the bumper.
- Before flying, verify that all channels of all modules are functioning properly.
- Make sure that each RS15 / CD18 / GEO SUB is producing the proper front/rear summation: when listening from behind the array, switch the front drivers in and out. You should hear a reduction in the LF range when the both front and rear drivers are on as compared to when the rear drivers only are on. When listening from the front, you should hear a strong increase in the LF range when connecting the rear drivers.
- To check that all front elements have the proper amplitude and phase, you should listen to the upper boxes at a close distance (<1 meter). You should be able to move from the top to the bottom of the cluster without hearing any change in the tonal balance.
- Verify that the angle settings are the same on both sides of each module.
- Raise the bumper, attach the next series of modules and repeat the above checks.
- Make sure that these series of modules sum properly with the modules above them.
- When all the modules are flown, check that the aiming angles are the same left and right.
- Make sure that multiple GEO S12 and RS15 / S2 / CD18 / GEO SUB are summing properly: 6 dB gain per doubling of quantity.

12.5 Final Pre-Sound Check Check

Play a CD track mono left, and then right: both sides must sound strictly identical. When listening in the centre between Left and Right GEO S12's, everything from LF to HF should be located to the "phantom centre" position. If not, repeat the above check sequence to identify the source of the problem.

13 TECHNICAL SPECIFICATIONS

13.1 GEO S1230 Module

13.1.1 System specifications

PRODUCT FEATURES	GEO S1230
Components	HF: 1 x 3" voice coil, 1.4" throat 16 Ohms driver on a 5° hyperboloid reflective wavesource. LF: 1 x 12" (30cm) high excursion neodymium 16 Ohm driver.
Height x Width x Depth	344 x 675 x 400 mm (13 1/2" x 26 1/2" x 15 1/2") excluding accessories Rigging axis to axis height: 345mm (13 1/2")
Shape	30° Trapezoid.
Weight: net	26.8 kg (59.1 lbs) excluding accessories.
Connectors	2 x NL4MP SPEAKON 4 pole (In & Through)
Construction	Baltic birch ply with structured black coating.
Front finish	Molded Dark Grey Metal Grill.
Flying points	Two plates connecting with external accessories. Intercabinet angle adjustments = (16°) - 22.5° - 30°
SYSTEM SPECIFICATIONS	**GEO S1230 with NX242 TDcontroller & NX-tension Card**
Frequency response [a]	53 Hz – 19 kHz ± 3 dB
Usable range @-6dB [a]	50 Hz – 20 kHz
Sensitivity 1W @ 1m [b]	103 dB SPL nominal
Peak SPL @ 1m [b]	131 to 133dB Peak (for 500 to 900 W RMS Amplifier)
Dispersion [c]	Coupling Plane: 28.5°. Non-Coupling Plane: Configurable 80° / 120°.
Crossover frequencies	LF-HF: 1.1 kHz Passive or Active (internally configurable)
Nominal impedance	HF: 16 Ohms; LF : 16 Ohms;
Recommended amplifiers 3 GEO S1230 in Parallel	HF: 875 to 1550 Watts into 4 Ohms LF: 1750 to 3100 Watts into 4 Ohms
4 GEO S1230 in parallel	HF: 1000 to 1800 Watts into 4 Ohms LF: 2000 to 3600 Watts into 4 Ohms
6 GEO S1230 in parallel	HF: 1650 to 3000 Watts into 2 Ohms LF: 3300 to 6000 Watts into 2 Ohms
SYSTEM OPERATION	
Electronic controller	The NEXO TDcontrollers presets are precisely matched to the GEO S12 Series cabinets and include sophisticated protection. Using GEO S12 Series cabinets without a properly connected NEXO TDcontrollers will result in poor sound quality and can damage components.
Sub-bass	CD18 / GEO SUB / S2 extend system low frequency response down to 32 Hz / 38 Hz / 32 Hz
Speaker cables	Active:; 1-/1+:LF; 2-/2+: HF Passive: 1-/1+: Not Connected; 2-/2+:LF + HF.
Accessories	Please refer to the GEO S12 user manual before any operation.

As part of a policy of continual improvement, NEXO reserves the right to change specifications without notice.

[a] Response curves and data: anechoic far field above 200 Hz, half-space anechoic below 200 Hz.

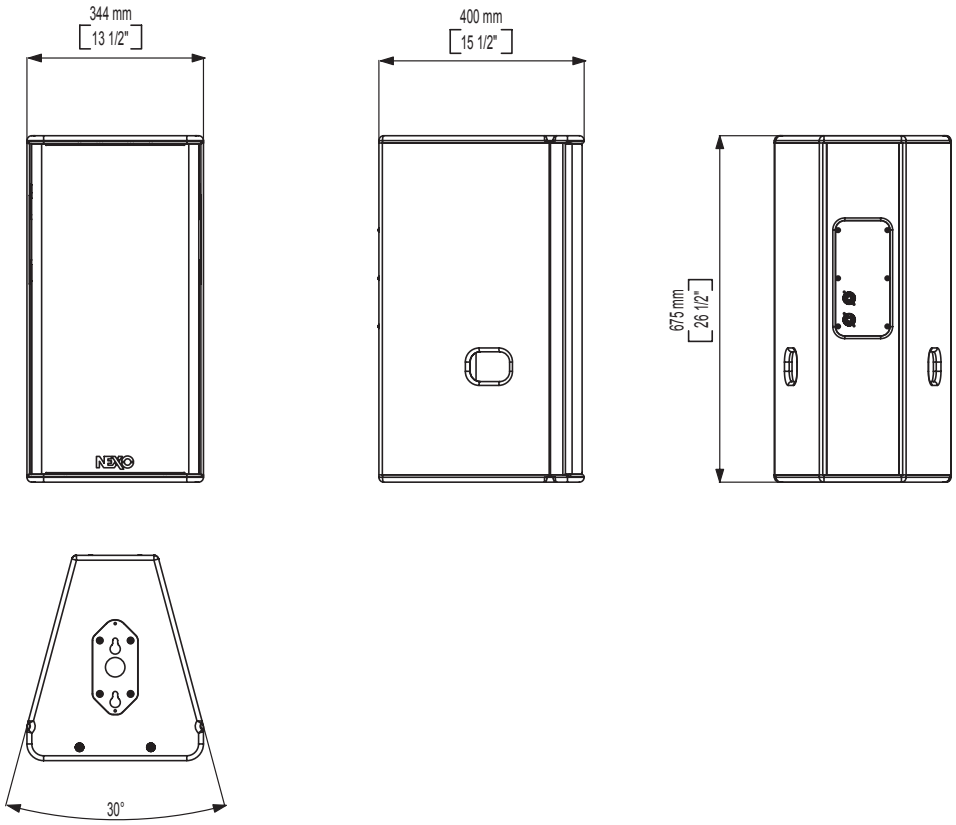
[b] Sensitivity & peak SPL: will depend on spectral distribution. Measured with band limited pink noise. Refers to the specified +/- 3 dB range. Data are for speaker + processor + recommended amplifier combinations.

[c] Directivity curves and data: 1/3 octave smoothed frequency response, normalized to on-axis response. Data obtained by computer processing of off-axis response curves.

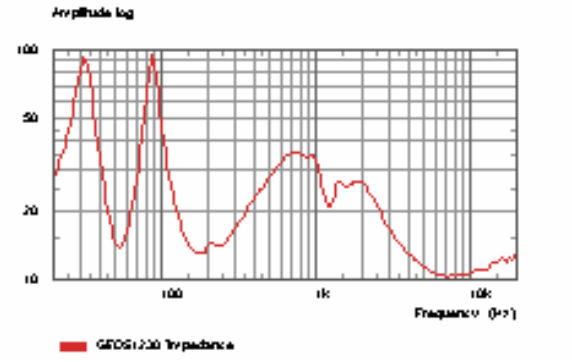
[d] Please refer to the GEO S12 user Manual.

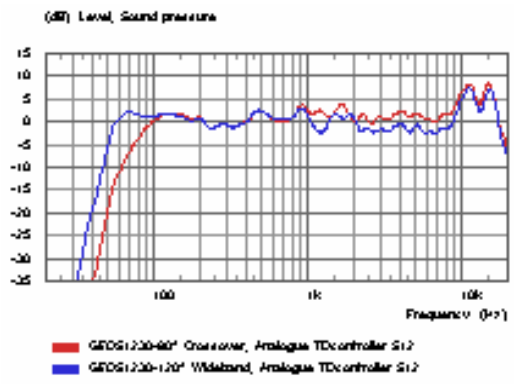
Usable range data: frequency response capability with TD crossover slopes removed.

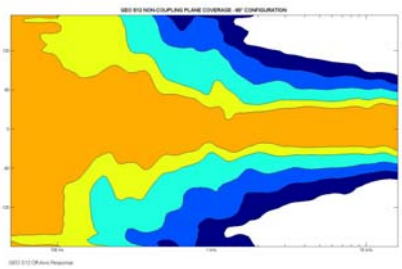
13.1.2 Dimensions

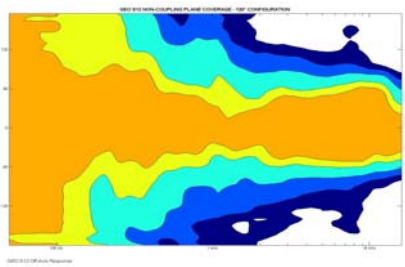


13.1.3 Diagrams









13.2 GEO S1210 Module

13.2.1 System specifications

PRODUCT FEATURES	GEO S1210
Components	HF: 1 x 3" voice coil, 1.4" throat 16 Ohms driver on a 5° hyperboloid reflective wavesource. LF: 1 x 12" (30cm) high excursion neodymium 16 Ohm driver.
Height x Width x Depth	344 x 675 x 378 mm (13 1/2" x 26 1/2" x 14 7/8") excluding accessories Rigging axis to axis height: 345mm (13 1/2")
Shape	10° Trapezoid.
Weight: net	28.05 kg (61.8 lbs) including array assembly system.
Connectors	2 x NL4MP SPEAKON 4 pole (In & Through)
Construction	Baltic birch ply with structured black coating.
Front finish	Molded Dark Grey Metal Grill.
Flying points	Two plates connecting with external accessories. Intercabinet angle adjustments = 0.2°, 0.315°, 0.5°, 0.8°; 1.25°, 2.0°, 3.15°, 5°, 6.3°, 8.0°, 10.0° (logarithmic steps)
SYSTEM SPECIFICATIONS	**GEO S1210 with NX242 TDcontroller & NX-tension Card**
Frequency response [a]	53 Hz – 19 kHz ± 3 dB
Usable range @-6dB [a]	50 Hz – 20 kHz
Sensitivity 1W @ 1m [b]	103 dB SPL nominal
Peak SPL @ 1m [b]	Configuration Dependent [d]
Dispersion [c]	Coupling Plane: Configuration dependent [d] Non-Coupling Plane: Configurable 80° / 120°.
Crossover frequencies	LF-HF: 1.1 kHz Passive or Active (internally configurable)
Nominal impedance	HF: 16 Ohms; LF : 16 Ohms;
Recommended amplifiers 3 GEO S1210 in Parallel	HF: 875 to 1550 Watts into 4 Ohms LF: 1750 to 3100 Watts into 4 Ohms
4 GEO S1210 in parallel	HF: 1000 to 1800 Watts into 4 Ohms LF: 2000 to 3600 Watts into 4 Ohms
6 GEO S1210 in parallel	HF: 1650 to 3000 Watts into 2 Ohms LF: 3300 to 6000 Watts into 2 Ohms
SYSTEM OPERATION	
Electronic controller	The NEXO TDcontrollers presets are precisely matched to the GEO S12 Series cabinets and include sophisticated protection. Using GEO S12 Series cabinets without a properly connected NEXO TDcontrollers will result in poor sound quality and can damage components.
Array design	Arrays of less than 4 x GEO S1210 will provide poor dispersion control and are neither recommended nor supported.
Sub-bass	CD18 / GEO SUB / S2 extend system low frequency response down to 32 Hz / 38 Hz / 32 Hz
Speaker cables	Active:; $1^-/1^+$:LF; $2^-/2^+$: HF Passive: $1^-/1^+$: Not Connected; $2^-/2^+$:LF + HF.
Accessories	Please refer to the GEO S12 user manual before any operation.

As part of a policy of continual improvement, NEXO reserves the right to change specifications without notice.

[a] Response curves and data: anechoic far field above 200 Hz, half-space anechoic below 200 Hz.

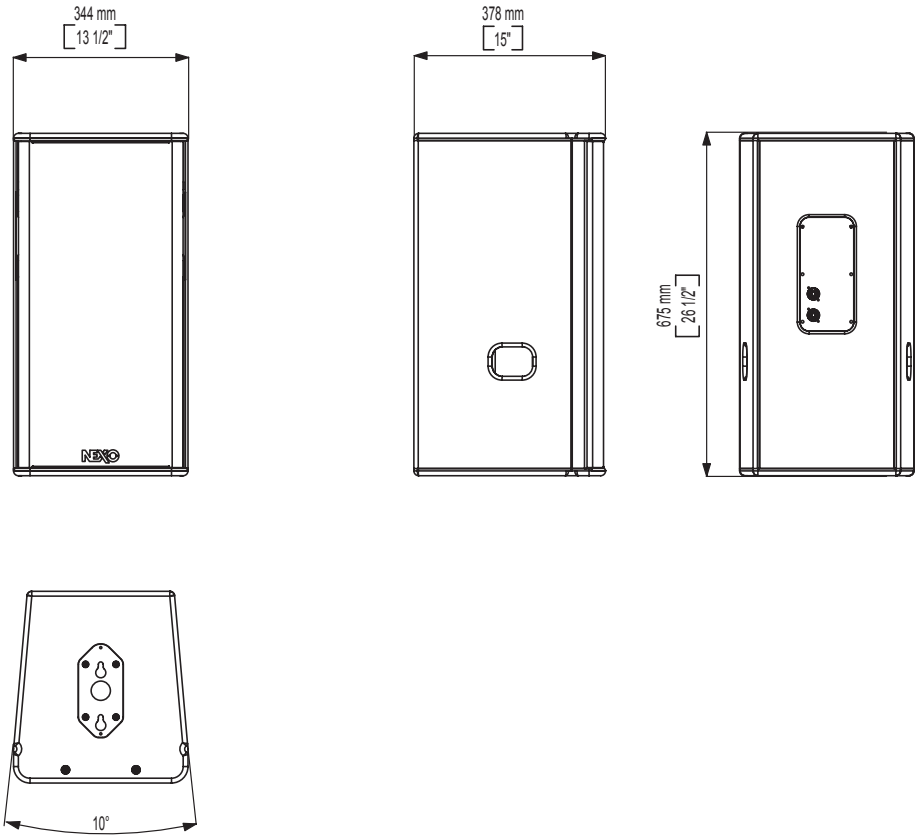
[b] Sensitivity & peak SPL: will depend on spectral distribution. Measured with band limited pink noise.
Refers to the specified +/- 3 dB range. Data are for speaker + processor + recommended amplifier combinations.

[c] Directivity curves and data: 1/3 octave smoothed frequency response, normalized to on-axis response. Data obtained by computer processing of off-axis response curves.

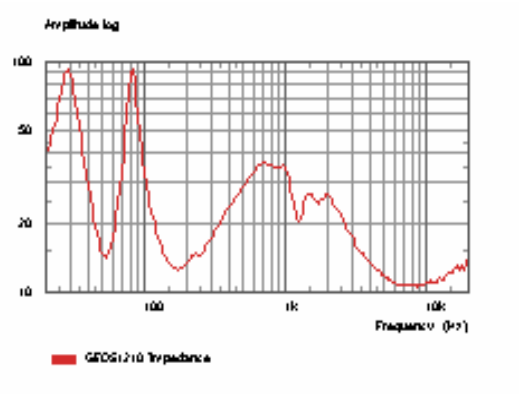
[d] Please refer to the GEO S12 user Manual.

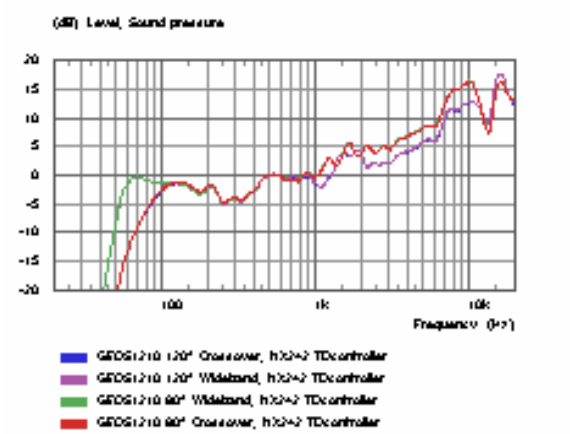
Usable range data: frequency response capability with TD crossover slopes removed.

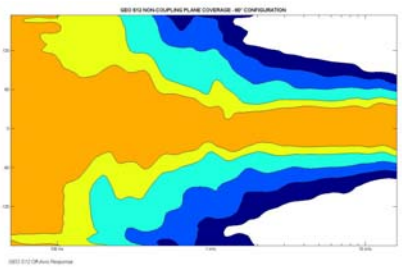
13.2.2 Dimensions

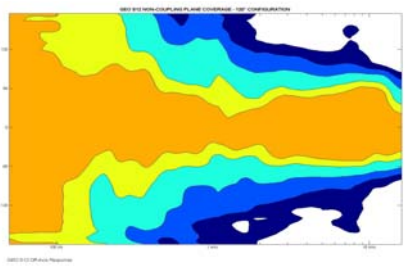


13.2.3 Diagrams




(dB) Level, Sound pressure
Frequency (Hz)
GEOS1210 120° Crossover, h3x4+2 TDcontroller
GEOS1210 120° Wideband, h3x4+2 TDcontroller
GEOS1210 60° Wideband, h3x4+2 TDcontroller
GEOS1210 60° Crossover, h3x4+2 TDcontroller

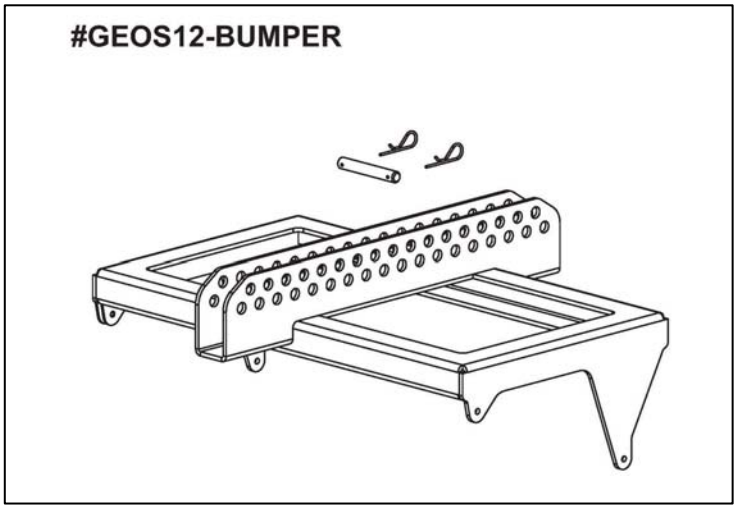




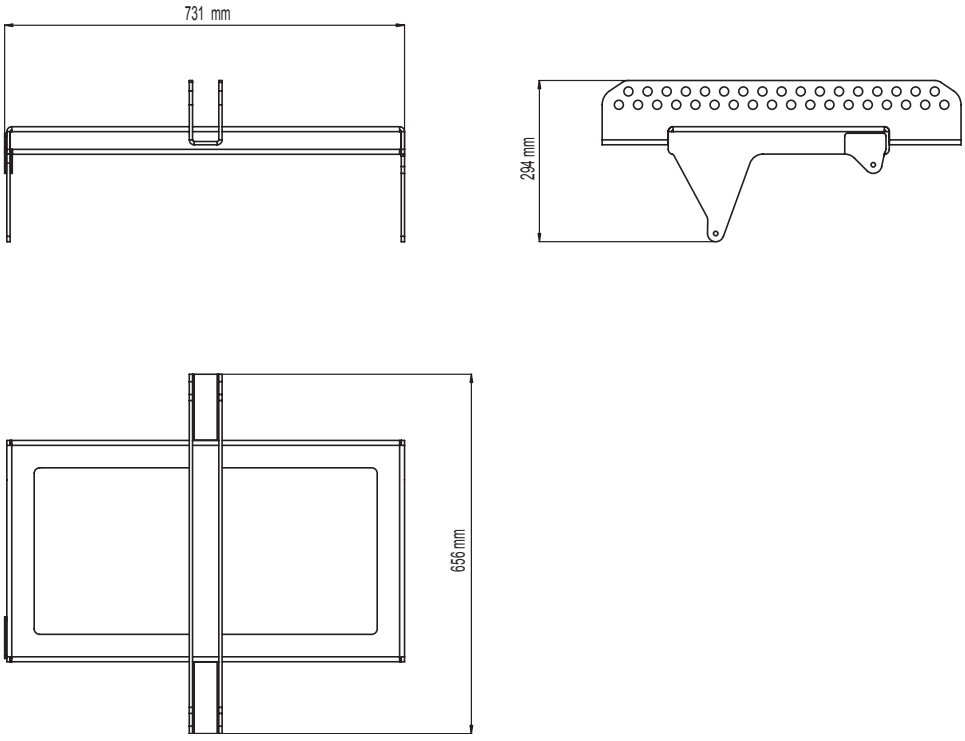
13.3 GEO S12 Touring Applications Accessories

13.3.1 GEO S12 Bumper

Parts



Dimensions

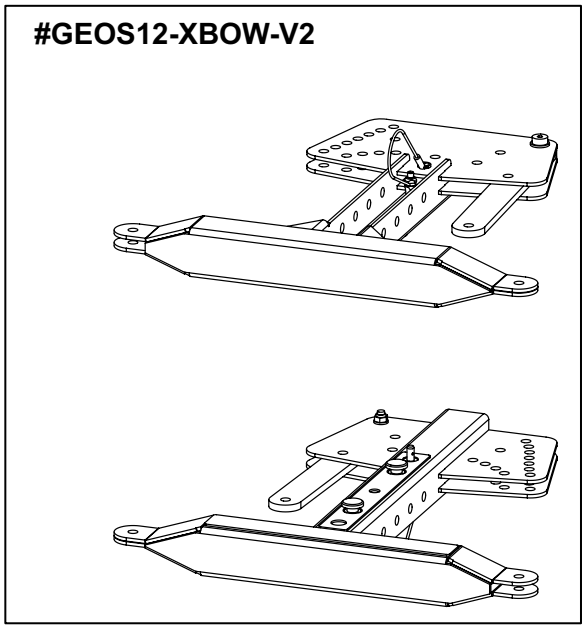


Weight

20 kg / 44.1 Lbs

13.3.2 GEO S12 Rigging Plates

Parts



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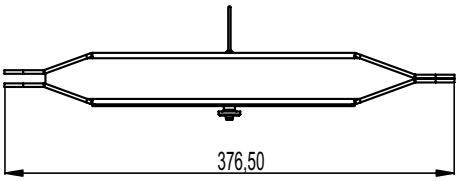
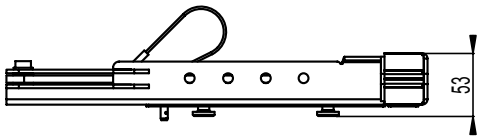
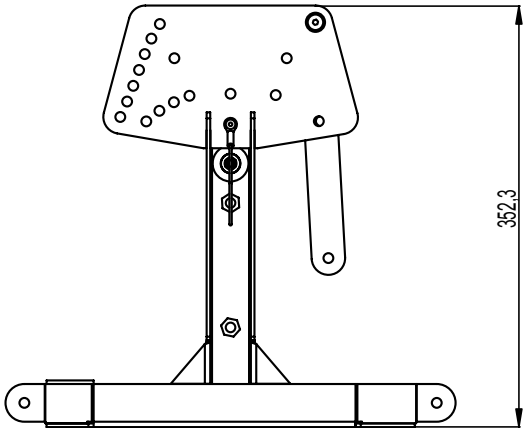




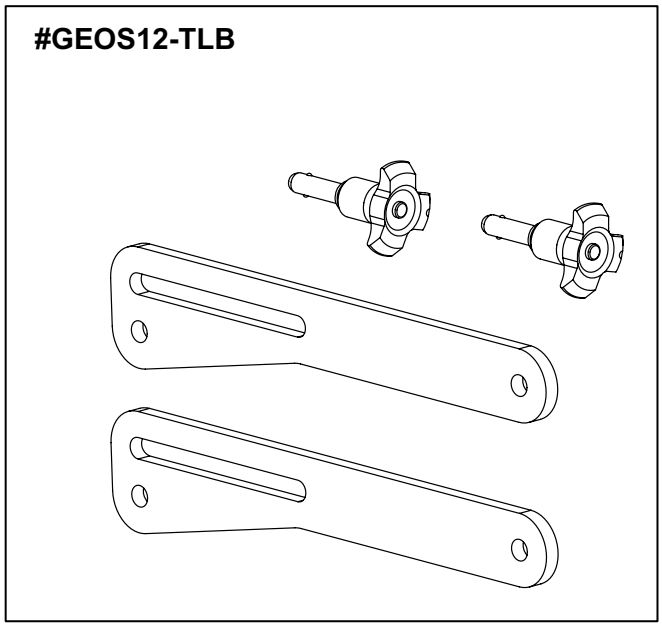


Weight (pair)

10.7 kg / 23.6 Lbs

13.3.3 Tension Mode Link Bars for GEOS12-XBOW-V2

Parts



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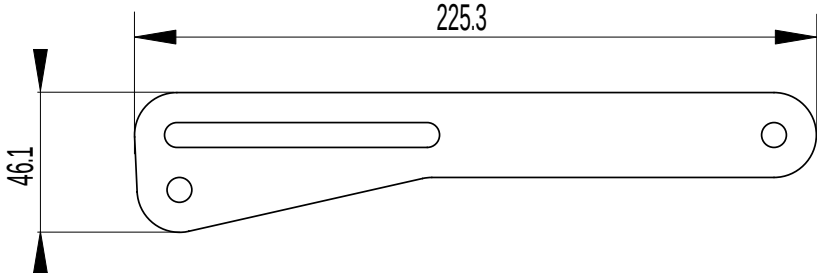
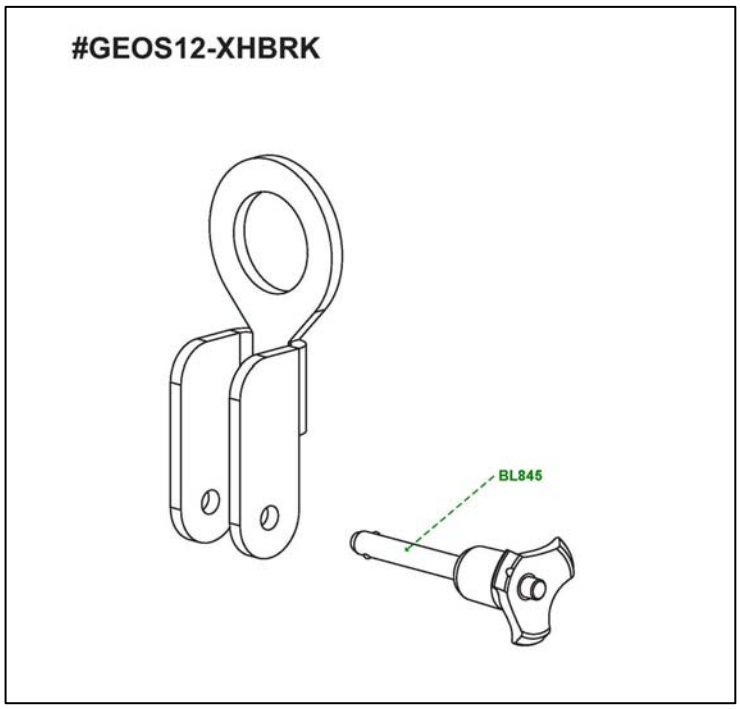


Weight (pair)

0.6 kg / 1.3 Lbs

13.3.4 Lifting Ring

Parts



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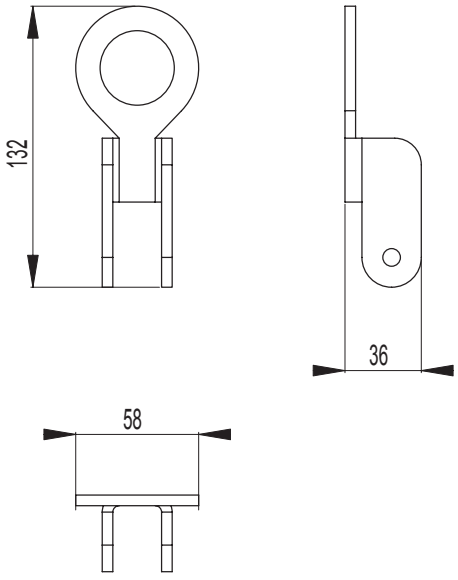
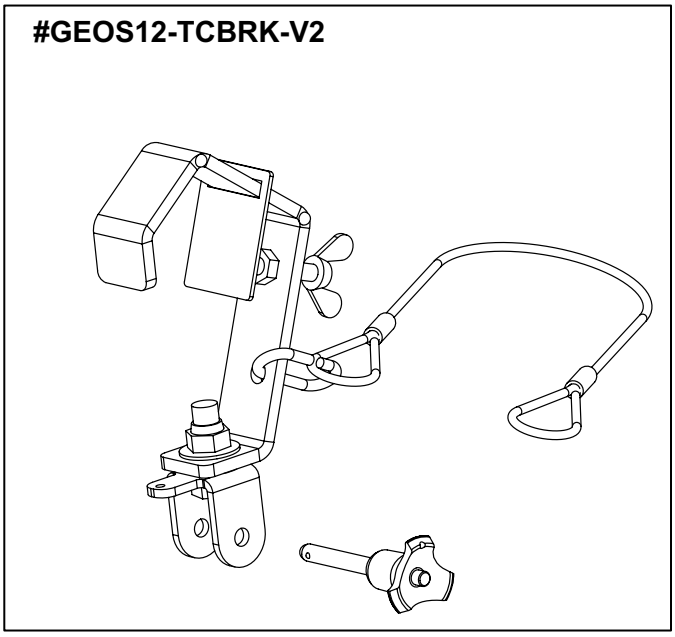


Weight (kit)

0.3 kg / 0.661 Lbs

13.3.5 Truss hook for GEOS12-SSBRK or GEOS12-PSBRK

Parts



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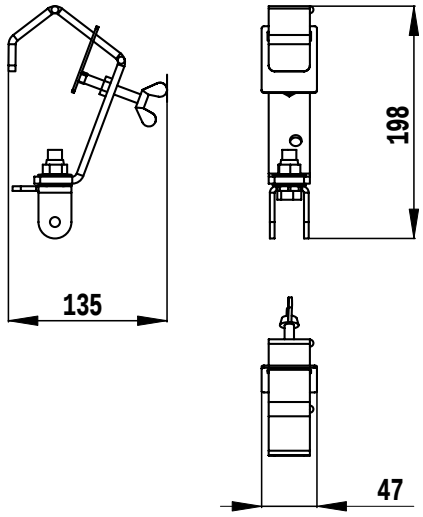
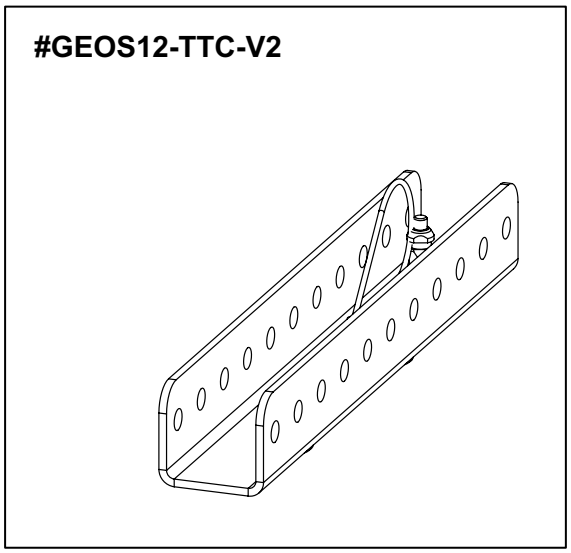


Weight (kit)

0.620 kg / 1.37 Lbs

13.3.6 Truss hook for single vertical GEO S12

Parts



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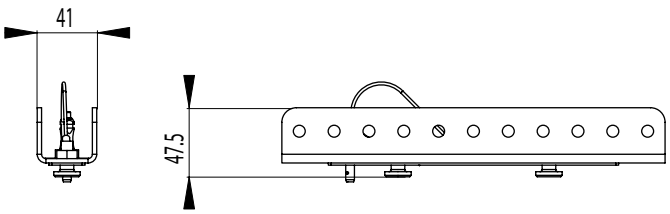
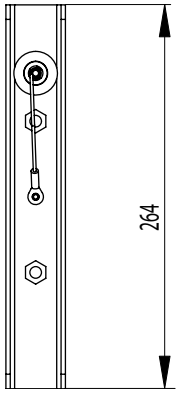


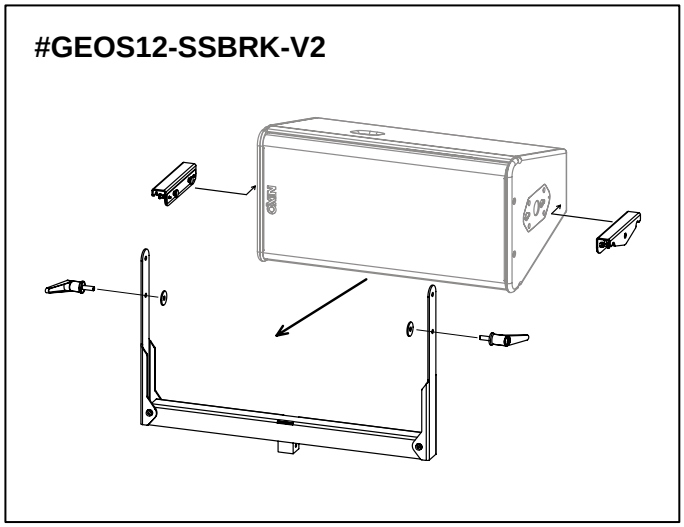


Weight (kit)

0.7 kg / 1.54 Lbs

13.3.7 "U" Bracket for single vertical GEO S12

Parts



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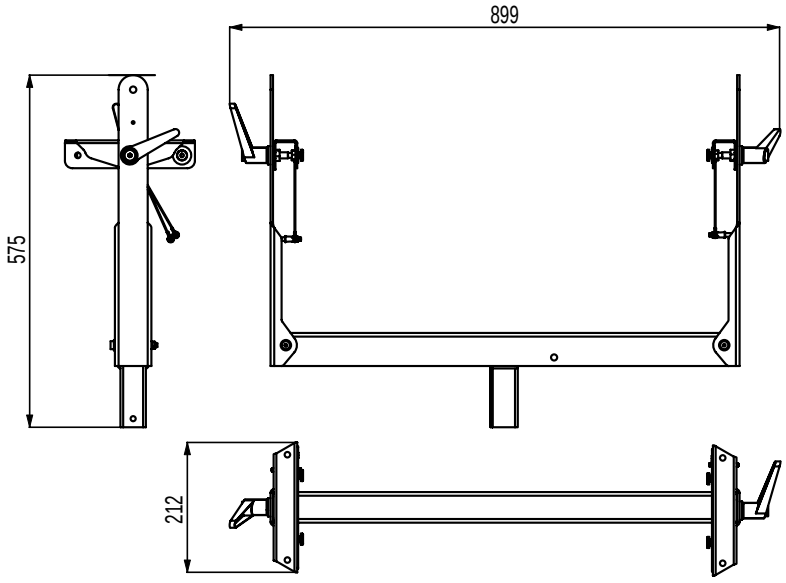
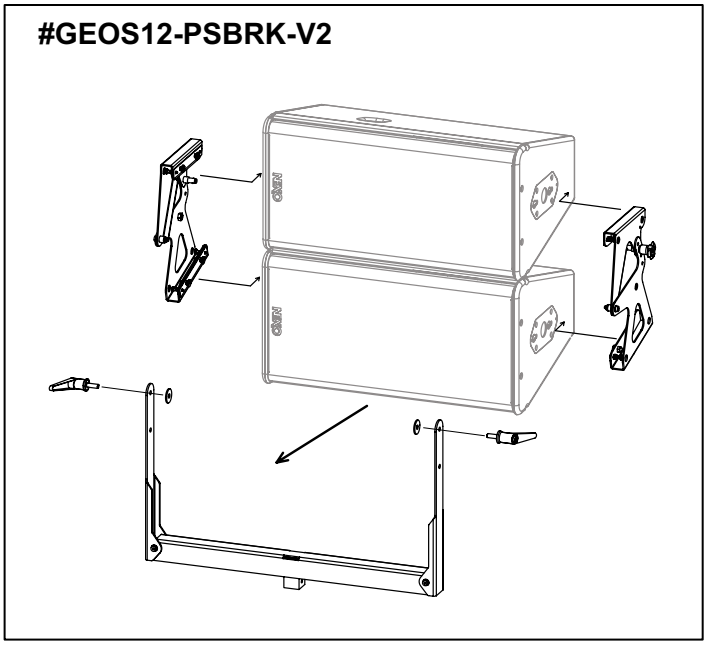


Weight (kit)

7 kg / 15.4 Lbs

13.3.8 U" Bracket for two vertical GEO S12

Parts



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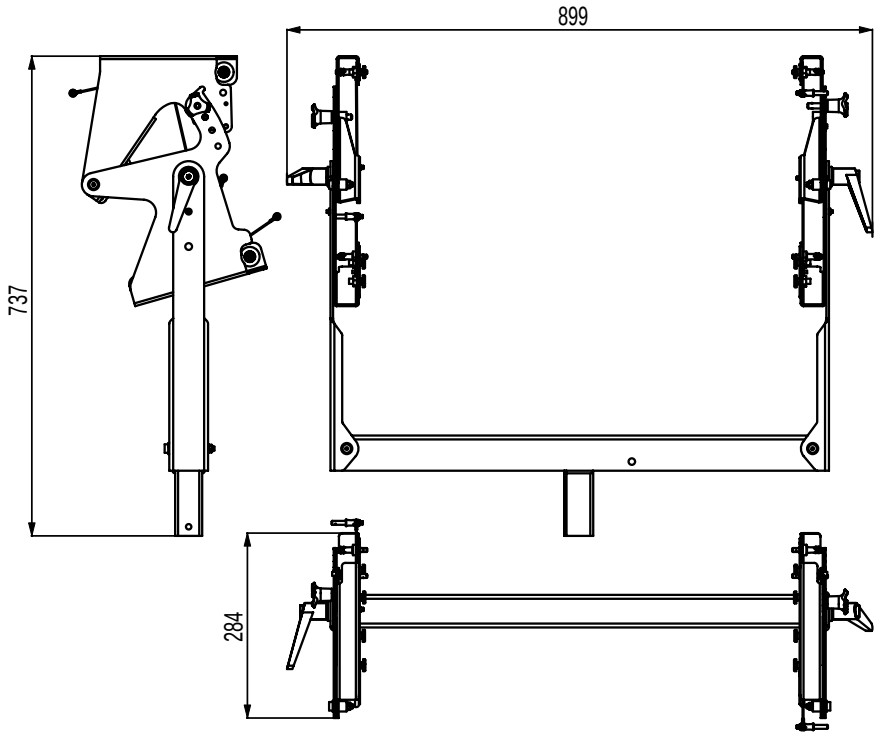
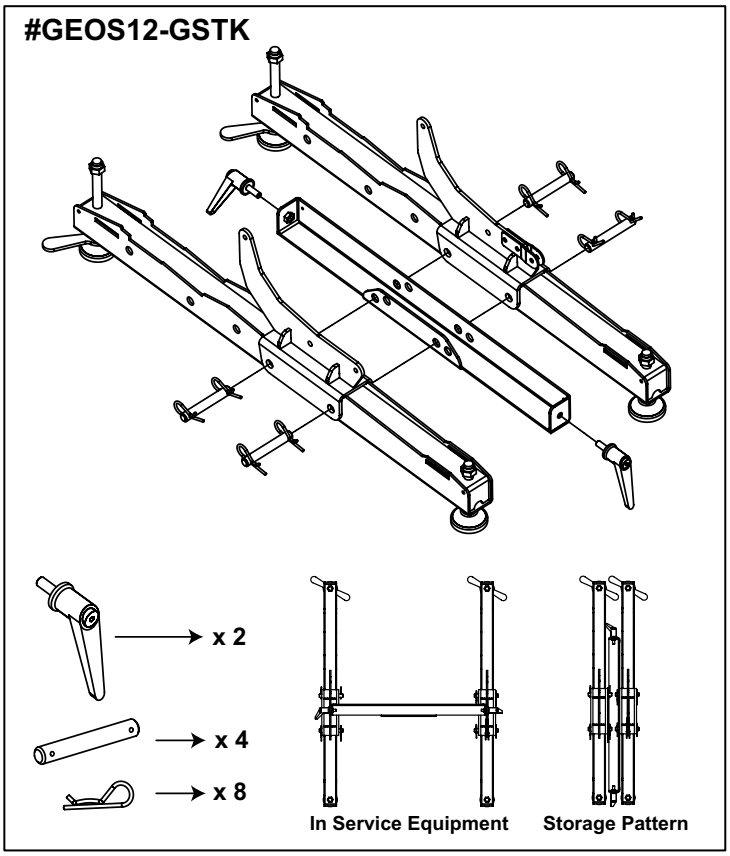


Weight (kit)

10.4 kg / 22.9 Lbs

13.3.9 Ground Stacking Device for up to 6 GEO S1210

Parts



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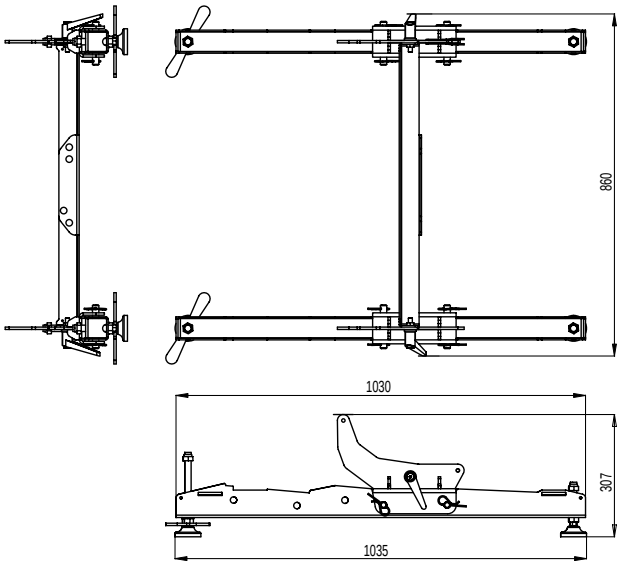


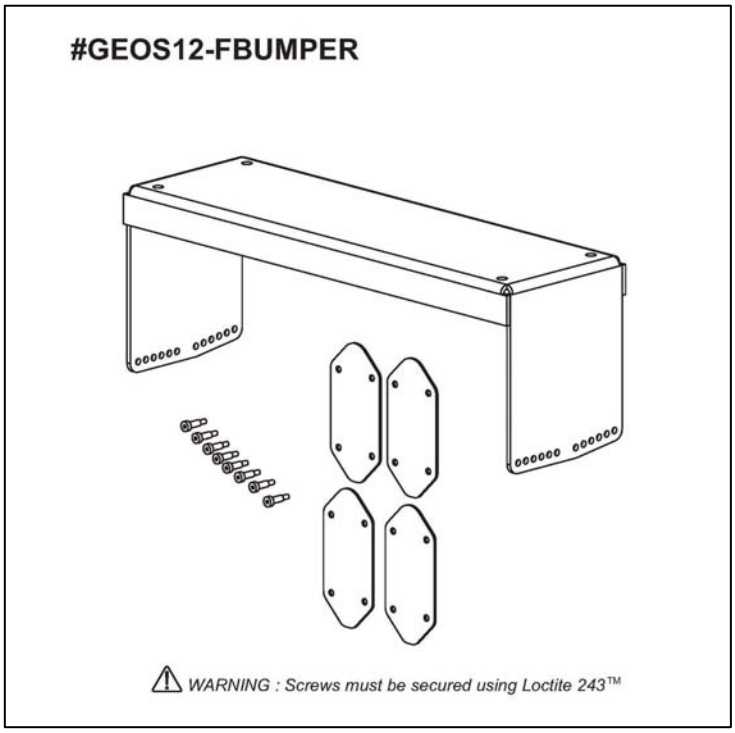
Weight (kit)

26.5 kg / 58.4 Lbs

13.4 GEO S12 Fixed Installations Accessories

13.4.1 GEO S12 Bumper

Parts



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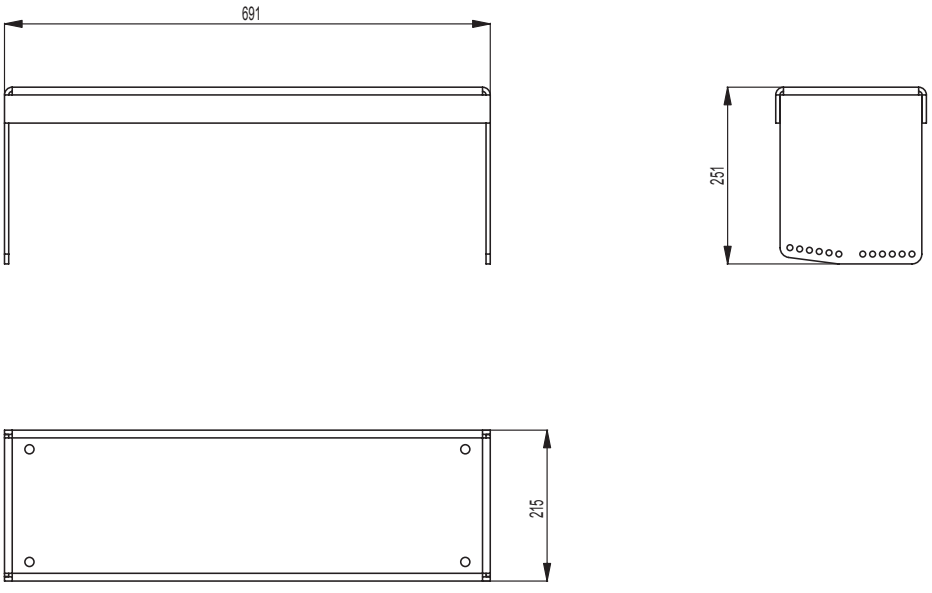
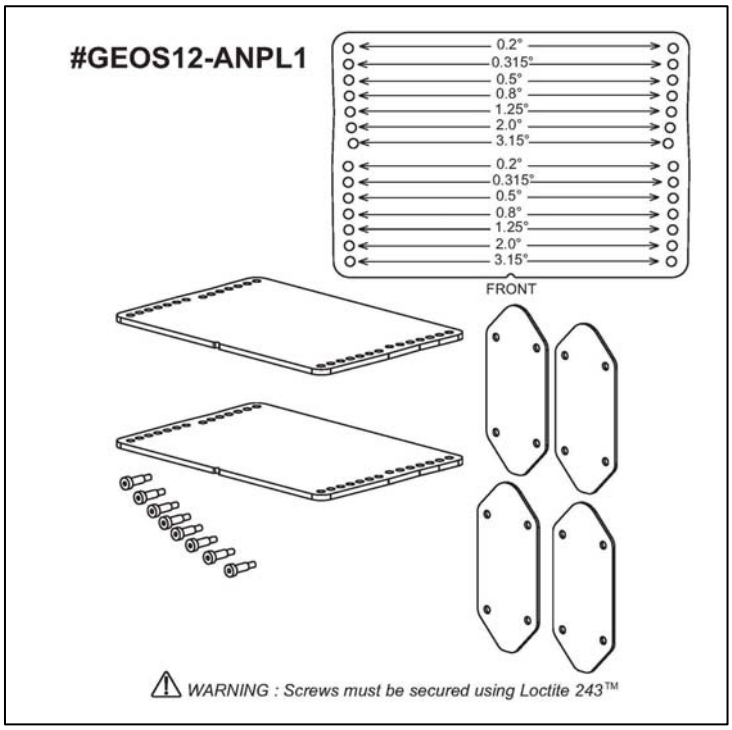


Weight (kit)

14.5 kg / 32 Lbs

13.4.2 GEO S12 Connecting Plate 1

Parts



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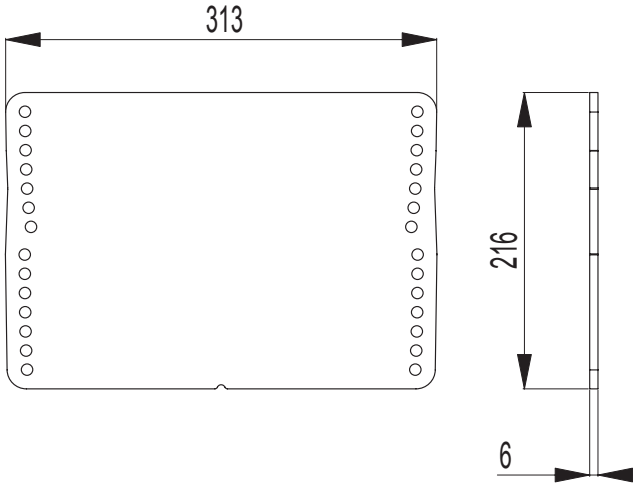
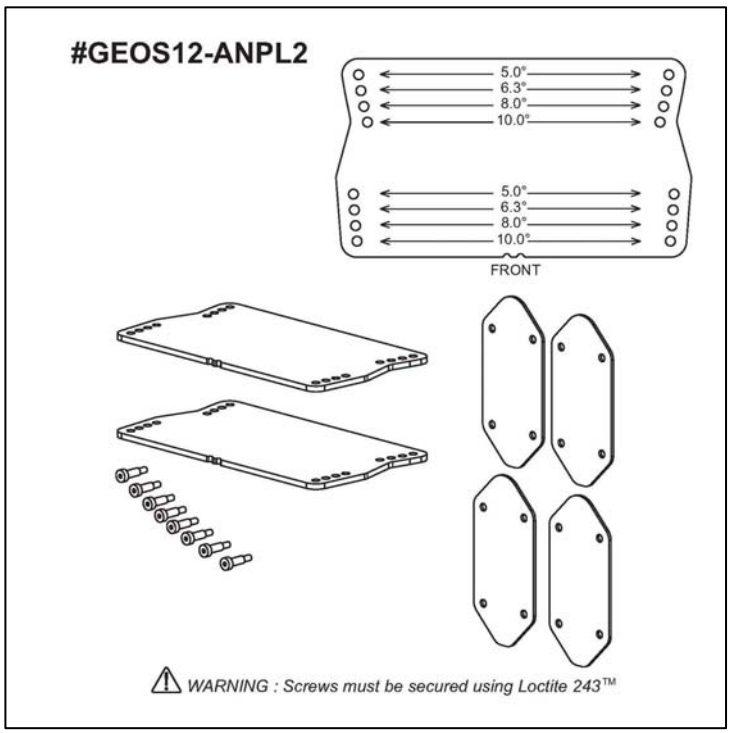


Weight (kit)

7.5 kg / 16.5 Lbs

13.4.3 GEO S12 Connecting Plate 2

Parts



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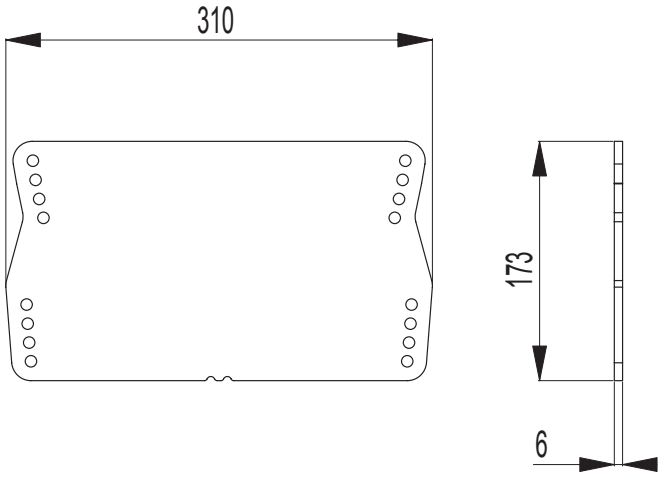
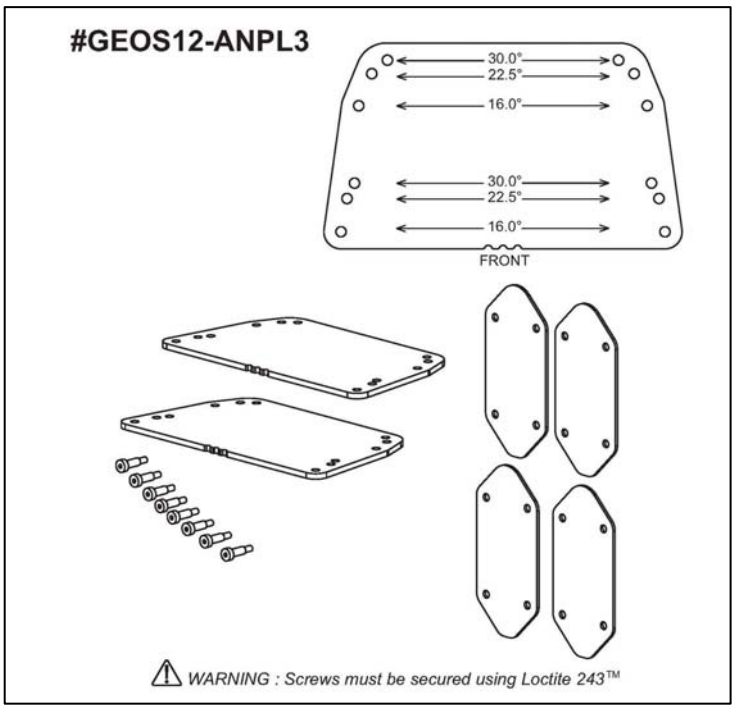


Weight (kit)

6.2 kg / 13.7 Lbs

13.4.4 GEO S12 Connecting Plate 3

Parts



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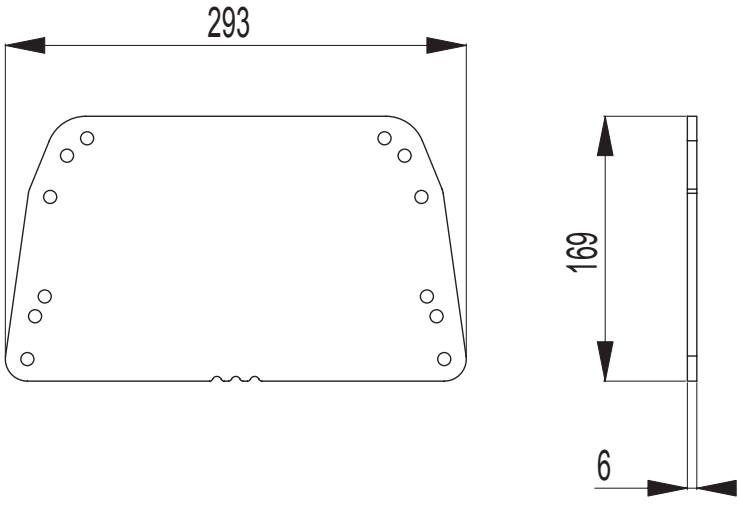


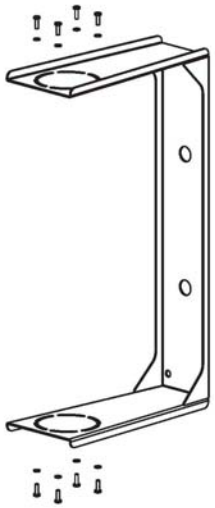
Weight (kit)

5.5 kg / 12.1 Lbs

13.4.5 Single GEO S12 “U” Bracket

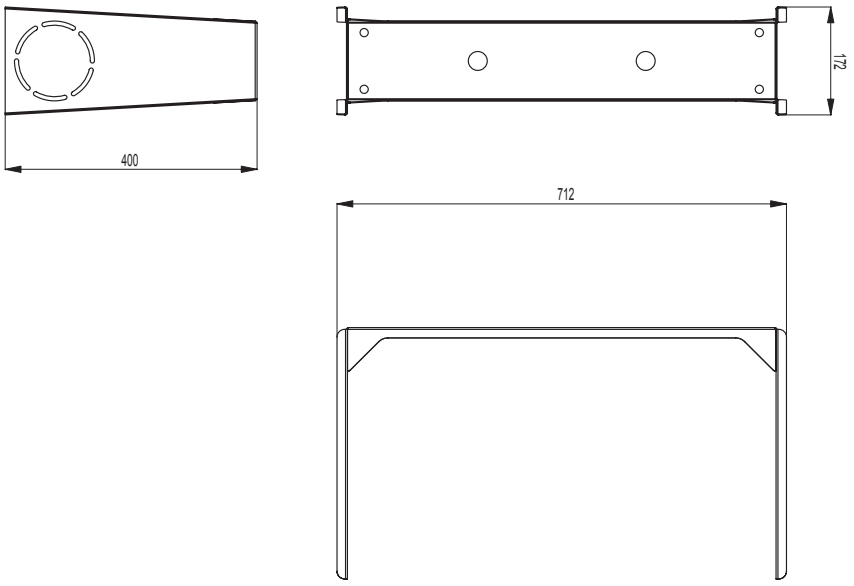
Parts

#GEOS12-UBRK



⚠ *WARNING : Screws must be secured using Loctite 243™*

Dimensions



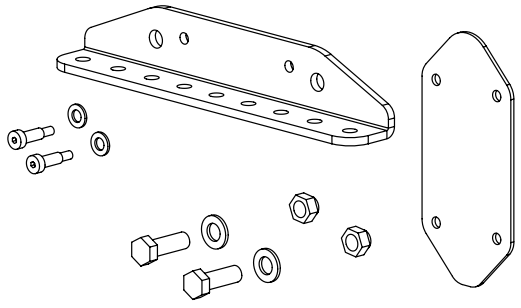
Weight

2.9 kg / 6.4 Lbs

13.4.6 "L" Bracket for cable suspension

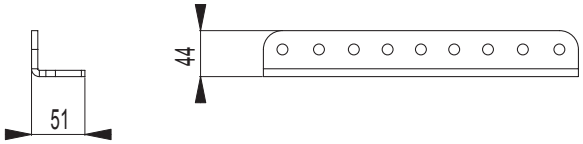
Parts

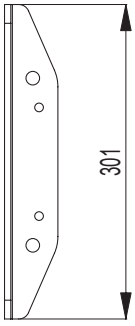
#GEOS12-LBRK



⚠ *WARNING : Screws must be secured using Loctite 243™*

Dimensions





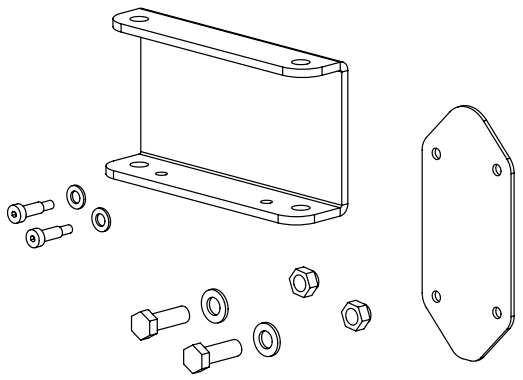
Weight (kit)

1.75 kg / 3.86 Lbs

13.4.7 "U" Bracket for rigid suspension

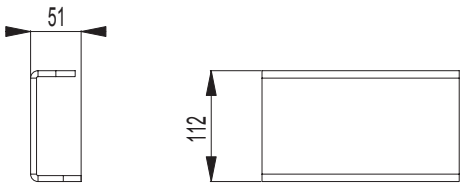
Parts

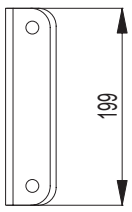
#GEOS12-ABRK



⚠ *WARNING : Screws must be secured using Loctite 243™*

Dimensions

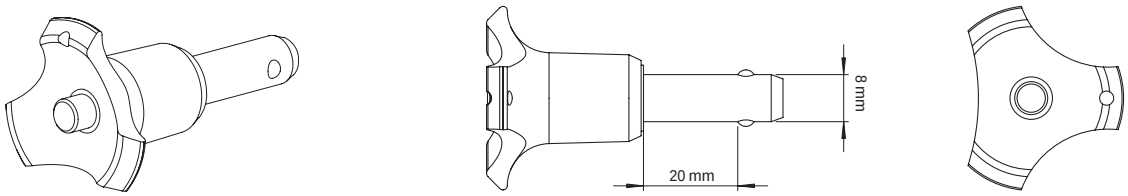




Weight (kit)

1.75 kg / 3.86 Lbs

13.4.8 GEO S12 Push-Pins (BLGEOS)



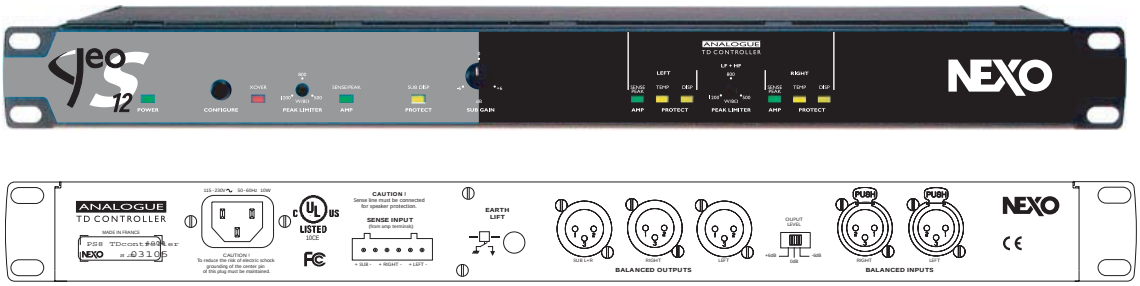
WEIGHT: 0.032 KG / 0.07 LBS

13.5 GEO S12 Analogue TDcontrollers

13.5.1 Specifications

SPECIFICATIONS	
Output Section	+22 /+16/+10 dBm typ. into 600 Ohm load. Back Panel switch on +6/0/-6dB respectively.
Input Section	Maximum input Level : 22dBu. CMRR 80dB @ 1kHz typ.
THD+N	0.1% @ 1kHz Typ. for +10dBm Output
Noisefloor	S12TD -100 dBV for 0dB switch position (22 Hz - 22 kHz, UnWeighted)
Dynamic Range	111 dB UnWeighted (THD+N at-60dBr sine wave @1kHz rel.max. output)
Crosstalk	104dB
Filtering & EQ.	L&R: 12dB/oct Low Pass, 12dB/oct High pass (crossover or overlap), 4 Parameter EQs. All factory tuned
Protections	VCA temp. (SUB,LF & LF), VCEQ disp. (SUB & LF), Peak Limiter (all chanels), Power compression regulation
Power Supply	100-250 Volts (continuous operation), 50/60Hz. Power 9W. Peak Inrush current 0.5A. Earth-Lift.
Conformity	Comply with safety objective of 73/23/EEC & 89/336/EEC directives. (EN60065-12/2001, EN55103-1996). CB scheme DK-8371, cULus 60065 AZSQ E241312, FCC part15 class B
PRODUCT FEATURES	
Audio Inputs	Two differential non floating L&R Audio inputs, 50 kOhm. Two XLR-3F connectors.
Sense Inputs	Three Amplifier Sense Inputs (S12 L&R, LS). 400 kOhm. 6 Pole Removable Strip Terminal
Audio Outputs	Two L&R S12 Audio outputs. Balanced, non floating, 51 Ohm. Two XLR-3M. One Mono (L+R) LS400 Audio output. Balanced, non floating, 51 Ohm. One XLR-3M.
Controls	Gain switch (back panel), 3 positions : -6 / 0 /+6dB. Peak Limiter trimmer (1200W-600W/8 Ohms) for S12 & Subbass Sub Overlap / Crossover switch & Sub Gain Control (-/+ 6dB).
Indicators	LF speakers Protect Yellow LED's (Temp. & Disp), Power ON (green), Amp Sense & Peak LED's (green/Red)
Dimensions	1U 19" Rack. 165mm (6.5") Depth
Weight :	2.9 kg (6.6 lbs) net
SYSTEM OPERATION	
Applicable Products	The S12 TDcontroller is precisely matched to the S12 & associated Subbass and includes sophisticated protection systems. Use of either product without a properly connected Controller will result in poor sound quality and may damage the components.
SubBass	Active two-way operation of the S12 Loudspeaker with the associated Subwoofer is included in the Analogue S12 TDcontroller .

13.5.2 Front and Rear Panel view

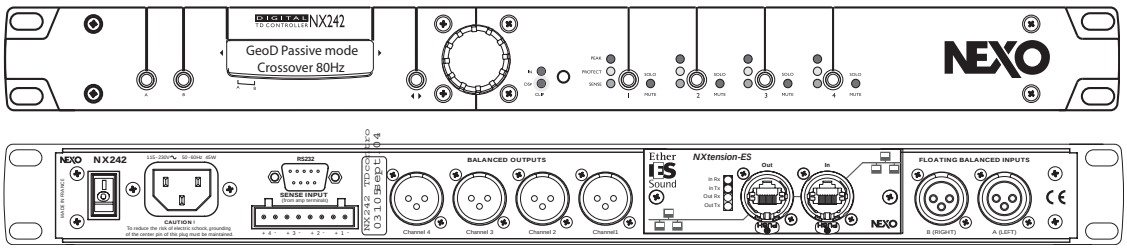


13.6 NX242 TDcontroller with NX-Tension Card

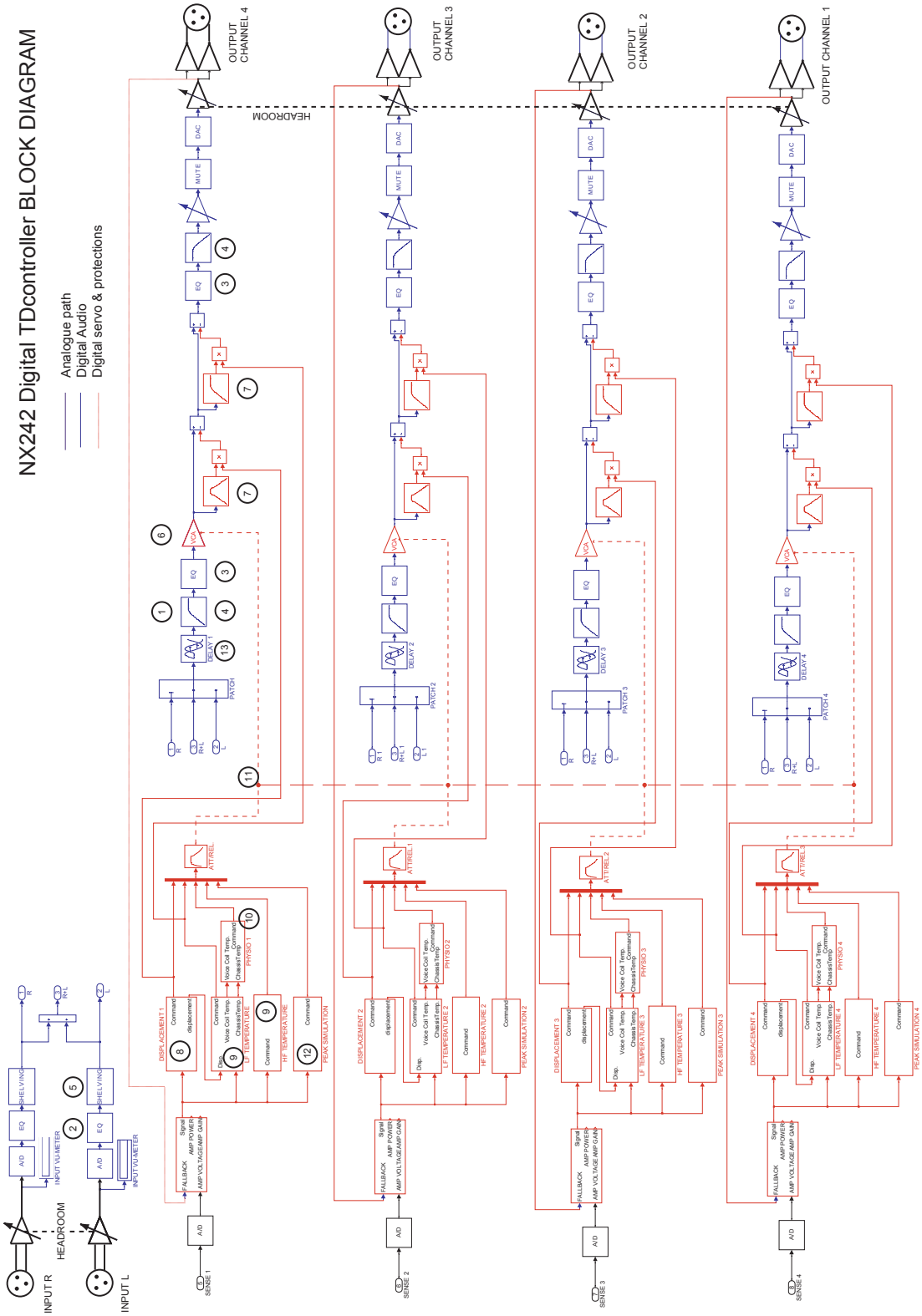
13.6.1 Specifications

SPECIFICATIONS	
Output Level	+28 dBu Max. into 600 Ohm load
Dynamic Range	110 dBu
THD + Noise	< 0.002% flat setup (for output at 27.5dBu)
Latency time	1.7ms on a flat setup
Power Supply	90V-260V
PRODUCT FEATURES	
Audio Inputs	2 Audio Inputs 24 bit converters Electronically Balanced, 50k Ohm. 2 XLR-3F Connectors. 4 Digital Ethersound Inputs with NXTension ES4 Card
Sense Inputs	4 Amplifier Sense Inputs Floating 150 kΩ. 18 bit converters 8 Pole Removable Strip Terminal.
Audio Outputs	4 Audio Outputs. 24 bit converters Electronically balanced, 50 Ohm 4 XLR-3M connectors 4 Digital Ethersound Outputs with NXTension ES4 Card (enabled for compatible amplifiers only)
Processing	24 bit data with 48-bit accumulator. 200 MIPS
Front Panel	Menu A and Menu B buttons 16 characters by 2 lines display Select Wheel & Enter button (◂ ▸) IN Clip – DSP Clip red LED's Speaker Protection yellow LED for each channel Individual Mute/Solo buttons and red LED for each channel Amp. Sense & Peak (green & red) LED's for each channel
FLASH EPROM	Software updates/upgrades, new system setups, available on www.nexo-sa.com
Rear Panel	RS232 connector for serial com 2 x RJ45 connectors with NXTension ES4 Card 1 RJ45 + 2 RJ11 with NXTension CAI Card
Dimensions & Weight	1U 19" Rack - 230 mm (9") Depth. 4 kg

13.6.2 Front and Rear Panel view

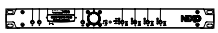
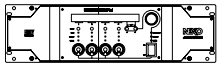
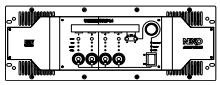


13.6.3 Block Diagram

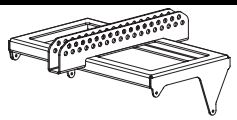
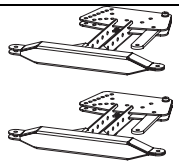
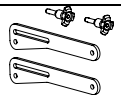


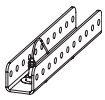
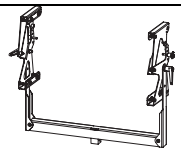
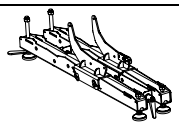
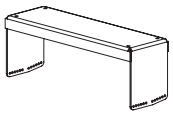
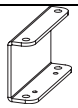
14 GEO S12 SERIES PARTS & ACCESSORIES LIST

14.1 Modules & Control Electronics List

MODEL	DRAWING	DESCRIPTION
GEO S1230		GEO S1230 Module
GEO S1210		GEO S1210 Module
NX 242–ES4		Digital TDcontroller
NXAMP4x1		Digital Powered Controller 4x1300W
NXAMP4x4		Digital Powered Controller 4x4000W

14.2 Accessories List

MODEL	DRAWING	DESCRIPTION
GEOS12-BUMPER		Main GEOS12 Bumper for touring application.
GEOS12-XBOW-V2		Rigging plates for touring applications (pair).
GEOS12-TLB		Link Legs for GEOS12-XBOW-V2 with Oblong Holes (pair, includes 2 8x20 Quick Release Pins)
BLGEOS		8x20 Quick Release Pin for Geo S8 / GeoS12 / RS15
GEOS12-XHBRK		Lifting Ring for GEOS12-SSBRK or GEOS12-PSBRK or GEOS12-XBOW (includes 8x45 Quick Release Pin).
GEOS12-TCBRK-V2		Truss hook for GEOS12-SSBRK or GEOS12-PSBRK or GEOS12-XBOW (includes 8x45 Quick Release Pin)

MODEL	DRAWING	DESCRIPTION
GEOS12-TTC-V2		Truss hook for single vertical GEO S12
GEOS12-SSBRK-V2		“U” Bracket for single horizontal GEO S12 on tripod or on truss hook or lifting ring
GEOS12-PSBRK-V2		U” Bracket for two GEO S12 on subwoofer pole stand or on truss hook or on lifting ring
GEOS12-GSTK		Ground Stack Device for up to 6 Geo S1210
GEOS12-FBUMPER		Main GEOS12 Bumper for fixed installation.
GEOS12-ANPL1		Connecting Plates / range: 0.20° - 3.15° for fixed installation.
GEOS12- ANPL2		Connecting Plates / range: 5.00° - 10.00° for fixed installation.
GEOS12- ANPL3		Connecting Plates / range: 16.00° - 30.00° for fixed installation.
GEOS12-UBRK		“U” Bracket for fixed installation.
GEOS12- LBRK		“L” Bracket for cable suspension (for fixed installation).
GEOS12- ABRK		“U” Bracket for rigid suspension (for fixed installation).
GEOS12-2CASE		Flight Case for 2 GEO S12 with accessory tray
GEOS12-3CASE		Flight Case for 3 GEOS12 equipped with XBOWS
GEOS12-BCASE		Flight Case for 2 GEO S12 bumpers and accessories

15 USER NOTES

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